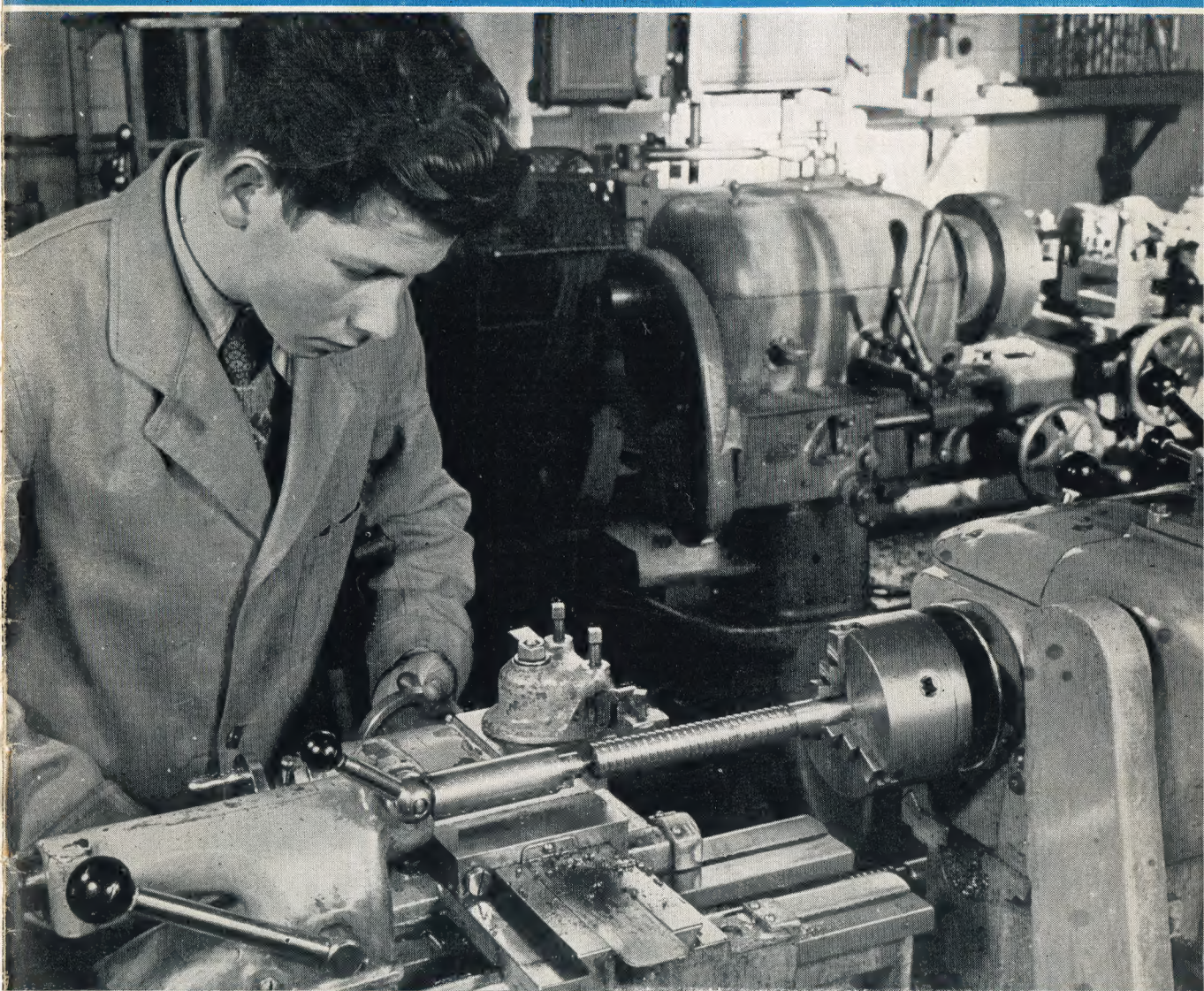
THE MODEL ENGINEER



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- TITFIELD THUNDERBOLT — DETAILS OF THE TENDER
- A SIMPLE DRILL-GRINDING JIG
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- FOCUS ON READERS' WORK
- A STEAM-DRIVEN STERN-WHEELER
- READERS' LETTERS

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Vol. 111 No. 2789

9D

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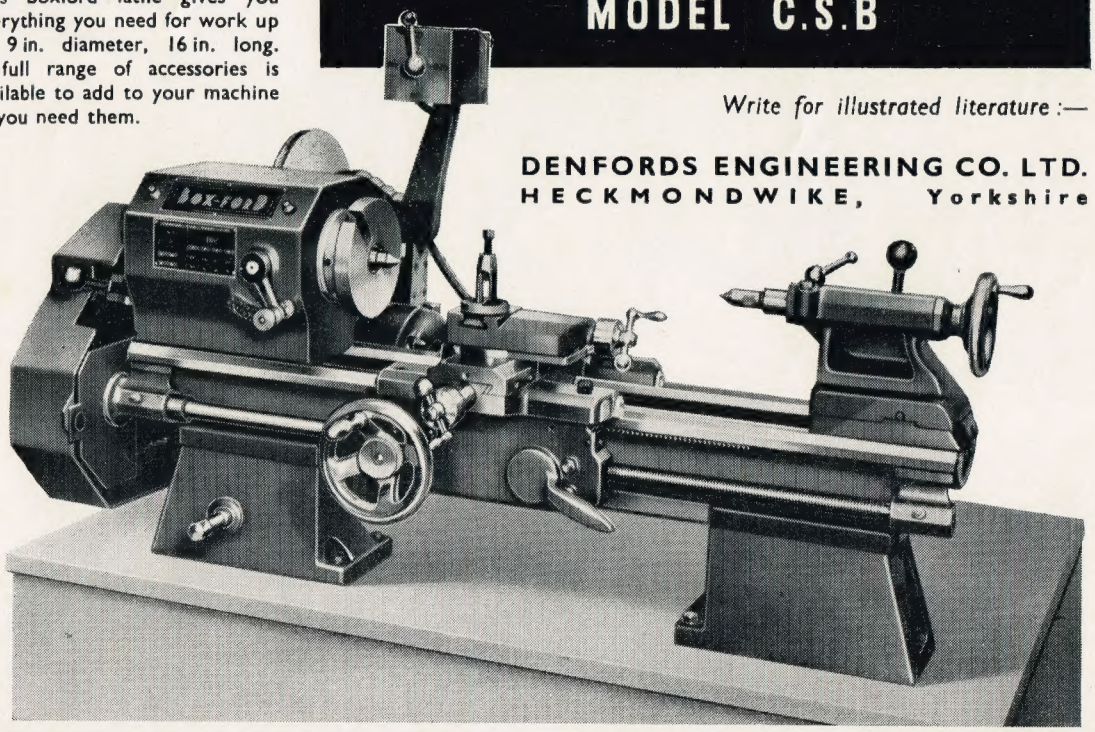

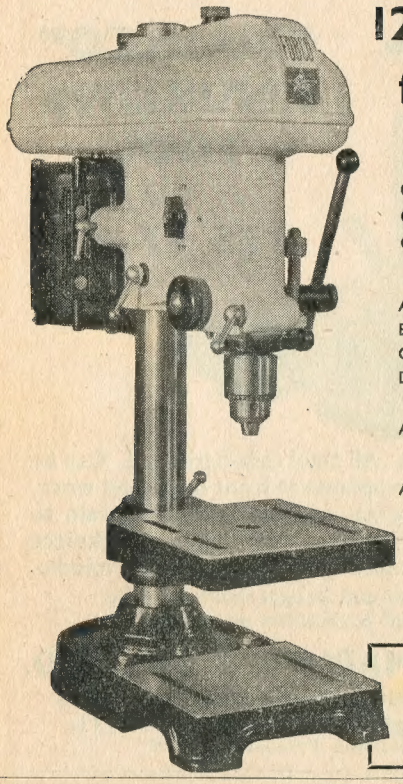

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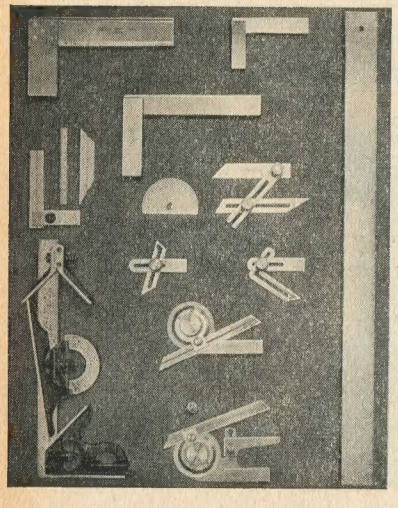

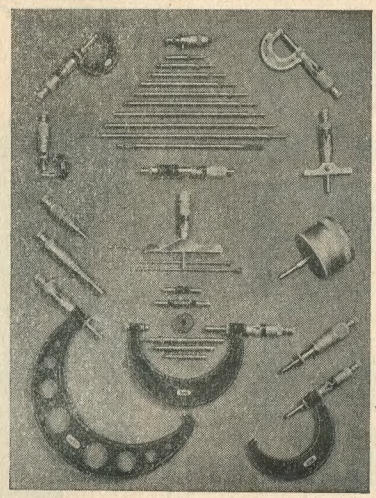

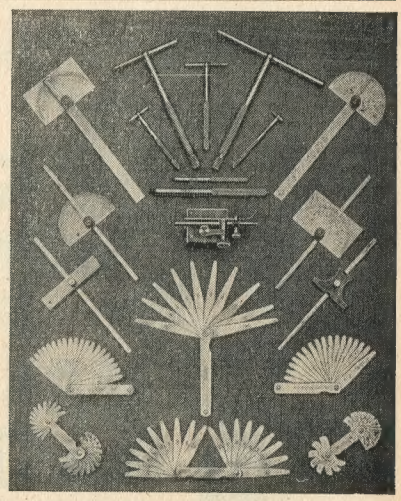

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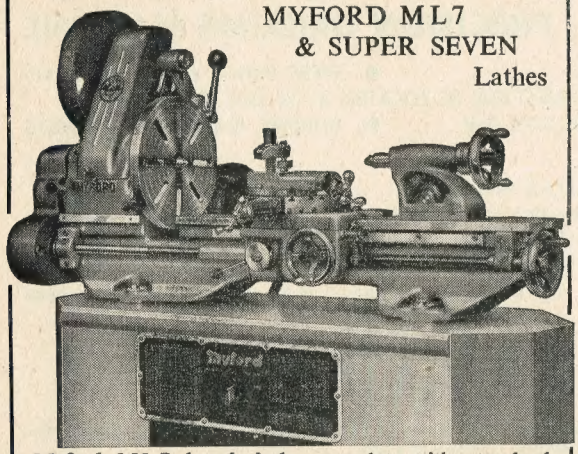

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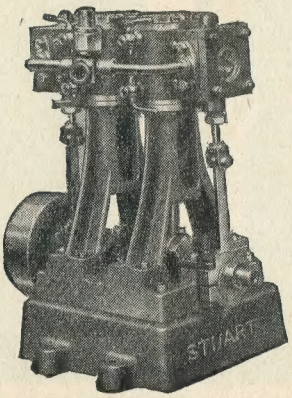

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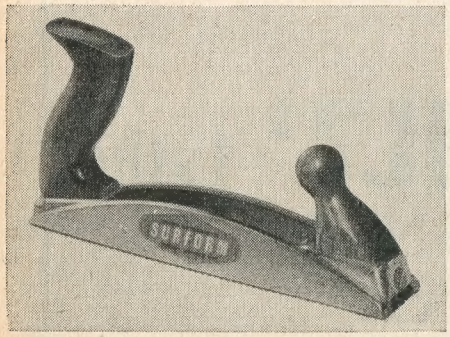

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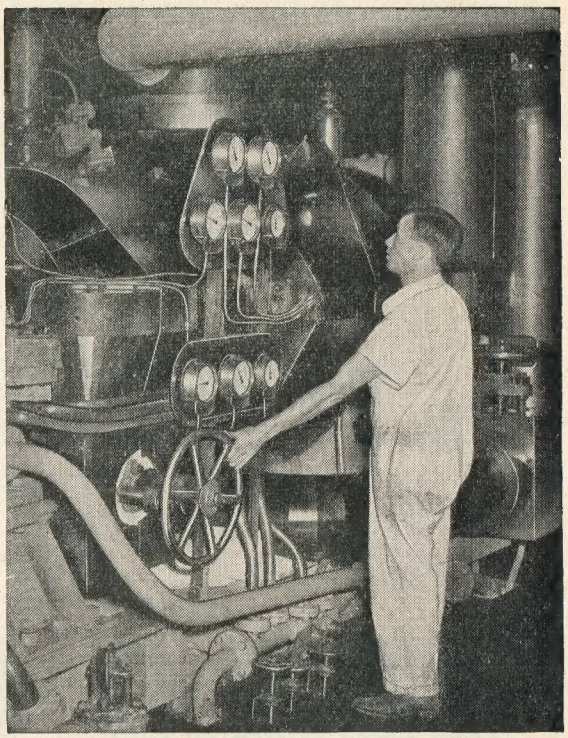

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THE MODEL ENGINEER

EVERY THURSDAY

Volume 111 - No. 2789

NOVEMBER 4th - 1954

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OUR COVER PICTURE

This photograph, submitted by Mr. D. H. Downie, of Witham, Essex, shows a pupil at work on a lathe at the Braintree Technical and Arts Institute. The operation in progress is the machining of a lathe tailstock spindle, including screwcutting the thread to a pitch of five threads per inch. Elsewhere in this issue will be found an article on the training of apprentices at Woolwich Arsenal. Nowadays, facilities for instruction in engineering and other industrial crafts are available at numerous technical establishments all over the country, and the modern student is indeed fortunate in the opportunities thus provided, compared with the training methods of the previous generation. Many of our older readers who had to learn their craft the hard way may reflect how times have changed, and how much more consideration is given to smoothing the path of modern youth—let us hope they fully appreciate it and profit by it.

SMOKE RINGS

The Kitten

IN THE October issue of *British Railways Magazine* (London Midland Region edition), there is printed the following story. Recently, when engine No. 46234, *Duchess of Abercorn*, arrived at Perth Motive Power Depot after working the 11.13 p.m. express from Crewe to Perth, a kitten covered with oil was discovered on an axlebox underneath the engine. It was in a very oily condition, but after being cleaned and fed it was restored to normal and played quite happily in its new surroundings. The only possible assumption is that the kitten had crept on to the engine before leaving Crewe shed, and the fact that it survived the long journey is rather amazing.

However, this may well have been the first of that kitten's nine little lives to be lost, and we can only hope that good luck will continue to favour it while it lives the other eight !

An Interesting Find

WRITING FROM South Africa, Mr. J. Busbridge tells us that, recently, a copy of the old " M.E." Series No. 13, " Machinery for Model Steamers," came into his hands after being salvaged by a friend, from a pile of ancient books, etc. It is a 3rd edition, price 6d. net, and, among other things, it advertises the " M.E." (at 2d. !) and Whitney Launch Engines. The " M.E." offices at the time were at Farringdon Street, and Mr. Busbridge enquires if we could tell him the age of the book; he imagines it to be well over 30 years.

It is in some ways a pity that these old handbooks of ours never gave any definite date of publication; an indication of this would make the books all the more interesting now. However, the result of our enquiries in this case shows that Mr. Busbridge's guess is, without doubt, correct; the book seems to have been originally published about 1910, and had definitely run to a third edition in 1914. This seems to suggest that model steamer building was enjoying something like a boom at that time ! At any rate, for an " M.E." handbook to reach a third edition in not more than five years is remarkable. But those old handbooks were extremely popular, right from the start, chiefly because they set a high standard in the art of providing excellent value at low cost.

This reminds us of the occasion many years ago, when a distinguished gentleman at the War Office rang us up to enquire if we could recommend him a good book on screw threads and twist drills. " It must contain all the proper gen., you know," he said. We recommended our handbook, price 9d. " Don't be silly," he replied; " I want something really comprehensive ! " And he rang off. We felt somewhat crestfallen; but as he had said who he was, we forwarded him a copy, with a little note asking if he would be kind enough to accept it with our compliments. He rang up, next day, to express his astonishment at the quantity and quality of the information in the book and to apologise for " my rather off-hand behaviour of yesterday." Later, we received a delightful note, together with 9d. enclosed!

Two More Traction Engine Rallies

ALREADY, ARRANGEMENTS have been made for two traction engine rallies to be held in 1955.

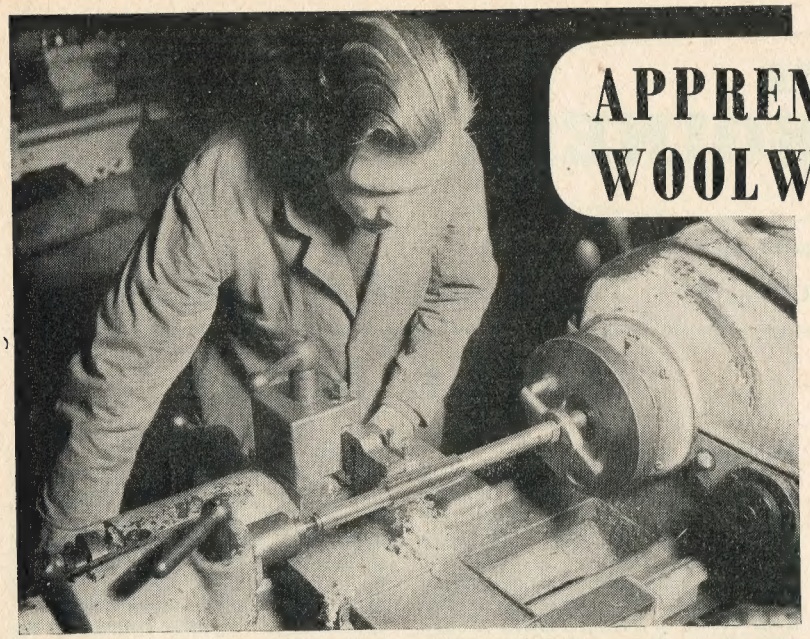
The Southern Federation of Model Engineers will be holding their rally at Finkley Manor Farm, Andover, on Saturday, May 14th.

The National Traction Engine Club will hold a rally at Bridge Farm, Appleford, Berks, on Saturday, June 11th. Further details about both rallies will be published as soon as available; but meanwhile everybody interested should make a note of the dates.

Incidentally, the National Traction Engine Club is a newly formed body catering for all who are interested in steam-driven road vehicles and tractors. There are two grades of membership; those who own road locomotives, etc., qualify for full membership, while anyone who is interested in the history and development of traction engines and the like may become an associate. In either case, the subscription is very low. Although the club is, as yet, less than six months old, the membership list extends to more than seventy. The secretary is Mr. Frank Stephens, 52, Bedford Row, London, W.C.1.

APPRENTICES AT WOOLWICH ARSENAL

By Antony Glasier



An apprentice, screwcutting on the lathe

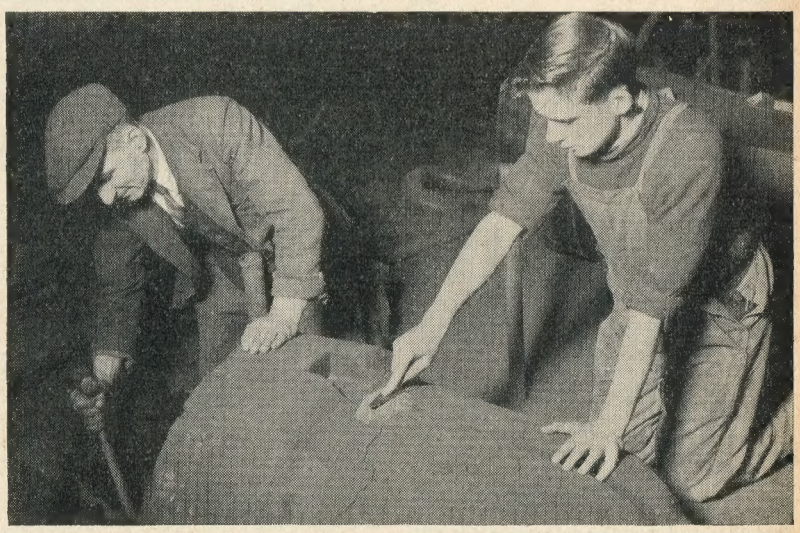
OVER a long period, Woolwich Arsenal has established a reputation for providing the finest engineering training available in this country. An impressive list of examination successes has been obtained by the apprentices and many of its former trainees have subsequently risen to the highest positions in the engineering world. The present administrators and instructors at Woolwich are conscious and proud of the tradition which has been built up, turning it to practical account in two ways. First, they utilise this long experience to make a constant effort to improve on existing training methods and are able to avoid adopting ideas which previous experience has shown to be unsatisfactory. Tradition, they therefore regard as a test for new methods and an incentive to improvement.

Secondly, they strive to instil this sense of tradition into the trainees so that its influence will produce something more than just first-class craftsmen. By continuing a long-established policy of strict but kindly discipline, they teach the students that such qualities as good timekeeping and the highest possible standards of conduct and craftsmenship are not the exception but what are expected from them as the normal pattern of behaviour. It has been found that the boys like this challenge to their responsibility and respond to it by maintaining the level expected of them.

The system of training carried on at the Arsenal since before the 1914-18 war served as a model when in 1946 the Ministry of Supply adopted a uniform scheme for all its establishments, including the Royal Ordnance Factories, and although this article describes training at the Arsenal in particular it thus gives also a general indication of training at other M.O.S. establishments.

There are two classes of apprenticeship—one designed to produce engineers of degree standard and the other to produce qualified tradesmen. Students in the first category are termed student apprentices (until recently engineering apprentices), of whom 16 are accepted by the Arsenal per year. Entrants, who must be between 16 and 18, follow a five-year course at the end of which they are expected to take the Higher National Certificate or B.Sc. engineering degree and thus qualify for a managerial or technical position. Such students are selected after a personal interview by a special board from among successful candidates at the competitive examinations held by the Civil Service Commission throughout the country each January.

The other class of trainees consists of the craft apprentices, who are recruited at 16 years of age. At Woolwich about 75 per cent. of the available places are filled from messenger and shop lads already working at the Arsenal. The remainder are taken from schools, especially those offering a technical education, in the "region" (i.e. Woolwich district and nearby counties). No examination is held for these entrants but weight is given, when they are interviewed by the Apprenticeship Board, to their school record and reports on their character and aptitude. The normal training period for craft apprentices is five years and there are opportunities for those who show special aptitude to be up-graded to student apprentice level. Indeed, the scheme for both classes of apprentice is worked out to allow trainees to obtain the highest qualification that their aptitude permits. Student apprentices enter *en bloc* in September each year, but craft apprentices, numbering about 30 per annum, are taken into



Moulder apprentice, working on a large core for a mould

the training workshop in two or three batches during the year.

The aim of the scheme is not only to provide trained engineers and tradesmen for the Arsenal itself but, since the intake of trainees is greater than the Arsenal can assimilate, to provide other government departments and industry with a supply of highly trained men in both categories. A proportion of the trainees do, of course, have an opportunity to join the staff on completion of training, depending on the current manpower requirements of the Arsenal. To ensure that no wastage occurs from the acceptance of apprentices who could not obtain the necessary standard of proficiency, the standard demanded at entry is constantly under review.

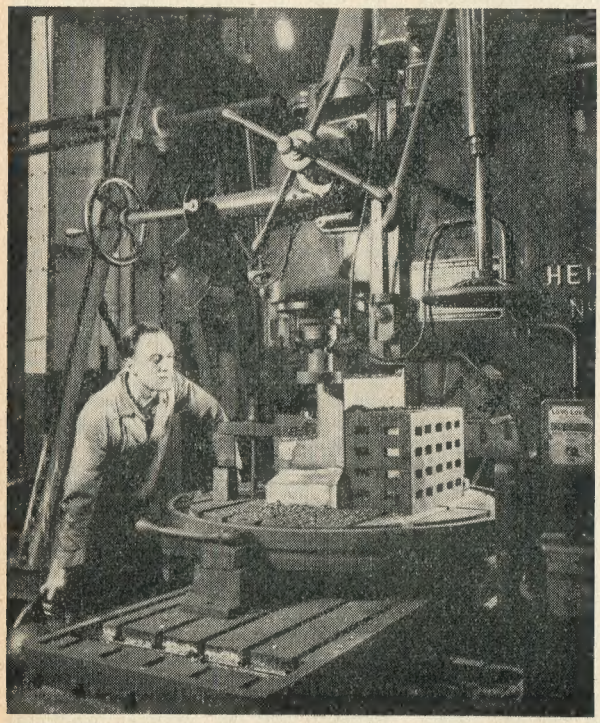
Practical teaching is provided in the apprentice training shop, which is staffed by a foreman, an assistant foreman, and 12 instructors who are chosen not only on account of their industrial experience and teaching ability but also because they have the right kind of personality to induce keenness among the boys. The shop is equipped with 103 machines, including 20 milling machines (vertical, horizontal, and universal), six shaping machines, four slotting machines, two radial drills, two pillar drills, one bench drill, and 40 centre lathes (bench and 4-in. to 10-in. centres). There are also two engraving machines, six surface grinders, one capstan lathe, one internal grinder, one rotary grinder, one universal grinder, four tool grinders, and one power saw. In addition, there are fitting benches, a hardening furnace, and examination slabs where work is examined by senior training shop apprentices.

Student apprentices spend two days per week at Woolwich Polytechnic for theoretical instruction. The Polytechnic has for many years had a very close association with the Arsenal and some senior members of the staff are on the board of the governing body of the Polytechnic. The training shop enjoys a particularly close and personal link with the Polytechnic as its assistant foreman, Mr. W. T. Walden, is a member of the governing body, by virtue of being a borough alderman. Craft apprentices receive up to 1½-days theoretical instruction per week, which may be taken at any institution of their choice providing a suitable curriculum.

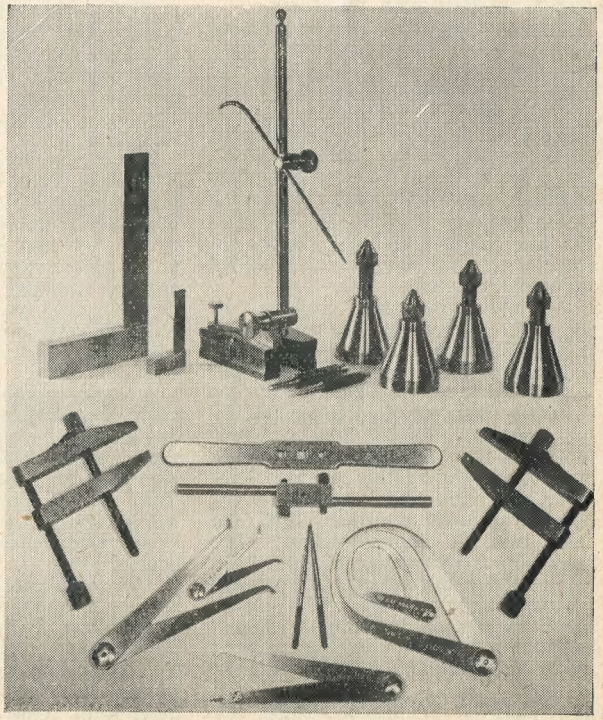
On entry to the apprentice training school, all trainees spend their first half-day receiving lectures, illustrated by visual aids, on such matters as safety first precautions and the care and use of tools and instruments. For approximately the first six months, each apprentice is engaged on making a kit of tools for himself, the work involving fitting, shaping, milling, and turning, and also a little drilling. The tools are manufactured from scrap metal, and, provided they are satisfactory on completion, can be purchased by the apprentice for 17s. 6d., and are inscribed with his name. They comprise 3 in. and 6 in. inside and outside calipers, two 4-in. toolmaker's clamps, a 12-in. scribing block, a pair of 6-in. hermaphrodite calipers, two tap wrenches for various sizes, two centre punches, two scribers, and four machine jacks.

Student apprentices receive one year in the training workshop and for the remaining six months of this period obtain experience on as many machines as time permits. Craft apprentices may receive up to 18 months in the training shop and when they have completed their set of tools, they spend the remainder of the time with up to two months on shaping and slotting, two months on grinding, and two months on milling. They then return to the lathes for about two months on factory production turning, followed by two months at the fitting benches. The final two months are spent on revision. They, therefore, pass out of the training shop with a sound practical knowledge on which to base their choice of trade.

Although this question of choice of trade is constantly kept in mind by the training staff and discussed with the apprentices, they also have two official opportunities to discuss the matter towards the end of their course in the shop—firstly at an interview with the apprentice supervisor and secondly when they appear before the Apprentice Board Selection Committee, which sits under the chairmanship of the superintendent of labour and includes two principal shop stewards—the apprentice supervisor, and the foreman of the training shop. The board considers reports on the boys' conduct and academic



One of the students operating a large milling machine



The set of tools made by all apprentices on joining

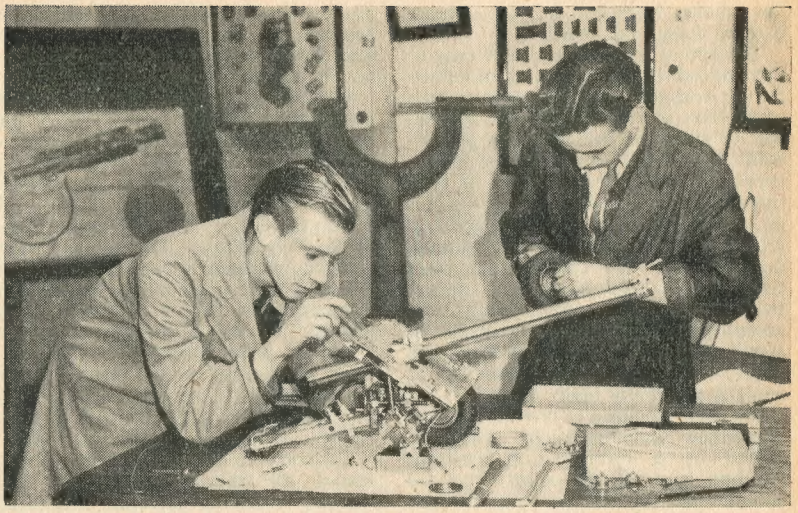
and practical training. In determining the trade into which each boy shall be placed, the board naturally has to take into consideration the amount of work available and the labour requirements of the Arsenal as a whole, but it usually finds it possible to place him in his first choice of trade. It is estimated that out of 800 boys who have passed through the workshop since it opened, 90 per cent. have been able to take up the trade they want to follow.

The trades open to them are turning, universal milling, fitting, grinding, millwrighting, and planing, shaping, and slotting. In addition to the training for mechanical engineering apprentices, the workshop also provides a six-months basic course, involving shaping, turning, fitting and milling, for apprentice electrical fitters and patternmakers. These trades are among a wide range of other courses, such as plumbing and carpentry, for which trainees can be apprenticed at the Arsenal.

On completion of the training courses, the mechanical apprentices receive an indenture. The craft apprentices are passed out into the factory to spend the remainder of their apprenticeship learning their particular trade. Each of them is placed under an individual mechanic instructor who receives an extra 7s. 6d. per week for undertaking this work. These mechanic instructors are specially selected to take an interest in the boys and give them every assistance possible. The Trade Union representatives join with the management in placing the highest importance on training of apprentices and never let any dispute interfere with this work.

Student apprentices also work under the mechanic instructors, but their remaining four years is divided as follows: six months in the heavy machine shop; six months on pattern-making and foundry work; six months in the drawing office; six months on fitting and erecting; six months on millwrighting and maintenance; six months in the electrical section; six months in the gas factory; and six months on metallurgy, which includes three months on blacksmithing.

On completing their training, all successful apprentices are awarded a certificate, endorsed to show their standard of proficiency, and this is granted independently of academic awards. An extremely high standard is attained by the apprentices during their first year in the training workshop. They obtain the fullest appreciation of fine limit work and often reach a standard not usually achieved elsewhere until the third year of apprenticeship. The workshop is from time to time called on by other departments to produce precision scale models, which are of great interest to the boys. Recent examples of the models are a Sagar 24-in. panel wood planer made to ¼ scale and a battalion anti-tank gun made to 1/5 scale. These two models exemplify the present activities of the Arsenal, which is engaged partly on civil production and partly on armaments. The B.A.T. gun fires a 5-in. shell and is standard army field equipment. Considering that these models were produced on full-size machine tools, their high degree of precision more than justifies the pride taken in the standard of work carried out by the apprentices.



Apprentices assembling the 1/5th scale model of a battalion anti-tank gun

The workshop has also been highly successful in competing for the Tom Nevard Memorial Cup, which is awarded annually for the best piece of unaided work by individual first-year apprentices at M.O.S. establishments. In 1952, the Arsenal took second prize with a pulley extractor and this year obtained first place with a universal ball-joint. In the academic sphere, Arsenal apprentices have also achieved an impressive list of awards.

An annual presentation is held at Woolwich Polytechnic, when prizes are awarded to the three top students in each craft and student group and also to the two best all-round students in both apprenticeship classes. Prizes are also awarded for good citizenship and for social services. The prize list for 1952 contained some 60-70 prizes, which take the form of instructional books or tools.

A small number of post-graduate engineering students are accepted, who are selected individually as being of a type who are likely to be able to fill high posts in engineering administration. They receive practical experience in workshop practice and spend six months in the training shop as part of their course.

There is an apprentice club and sports association and the boys also participate in any sports activities of the particular polytechnic at which they are studying. The normal working week is 44 hours, spread over five days. Students living away from home can stay at a hostel run for the Ministry of Supply by the Y.M.C.A. at Chislehurst, Kent, where partial board on weekdays and full board at weekends is provided for 42s. 6d. per week.

The Social Side

Amenities at the hostel include a study room, a fully equipped drawing office, and, on the social side, tennis courts and a room where table tennis can be played and dances are held periodically. The aim of the warden is to make it not an institution but a real home for the boys, while encouraging them to stand on their own feet. Parents are welcome to visit the hostel so that they will appreciate how excellently the boys are looked after. At present there are 61 residents, almost without exception student apprentices. Very close ties are maintained between the hostel and the Arsenal apprentice authorities and also the Ministry of Supply. Perhaps one incident more than any other shows how great a personal interest the hostel takes in the boys, for when a final year apprentice was married the hostel allowed him to hold his wedding reception there. This same boy is also a very good example of the sterling nature of a joint Arsenal and Woolwich Polytechnic education, because he obtained his M.Sc. in five years, and is believed to be the only person in the M.O.S. scheme to have obtained this degree in so short a period. At the annual prize-giving, an award is made to the apprentice who has given the best services to the hostel during the previous year.

An " open day " is held at the Arsenal for the parents of first-year apprentices, when the boys act as hosts and take their parents round the training workshop and introduce them to the instructors. This has been found instrumental in giving parents a reassuring insight into the tradition in which the boys are being schooled and the excellent conditions under which they work.

Making a Simple Beam Engine

A CHARACTERISTIC DESIGN BASED ON EARLY NINETEENTH CENTURY PRACTICE

By Edgar T. Westbury

IN the construction of an engine of this type, I strongly recommend that the materials employed are, as far as possible, in conformity with those used in the prototype, because it is more than likely that constructors will wish to exhibit the finished models, and "suitability of materials" is always an important factor in the eyes of the judges. It will be remembered that in the case of "utility" engines, designed primarily to do a job, I suggested that it would be permissible to take certain liberties in this respect, such as by the use of aluminium for structural castings which have to be painted nearly all over; but I should hate to think that this advice had been interpreted as licence to use any kind of material in a model purporting to be a reasonably true "period" representation. Aluminium or its alloys would, I feel, be quite incongruous with the construction of a beam engine—its use in engineering did not arrive until this type of engine was obsolete, and would be as anachronistic as introducing a telephone in a performance of *Hamlet* or a cigarette in *Julius Caesar*!

The most important material in the construction of early steam engines was cast-iron, and in view of the fact that facilities for machining were very limited, the components were designed so as to need very little of this treatment. In a model, it is not easy to produce accurate scale detail in the castings, or even in all cases to adhere to scale thicknesses in sections, but I have done my best in the adaptation of this design to ensure that the components can be cast in iron without any great difficulty, and also that such machining as is necessary does not involve insuperable problems, where normal model engineering equipment is available. The alternatives to the use of castings have already been discussed in a previous article, and need not be referred to again here. Components which were made in wrought iron in the prototype may quite legitimately be produced in mild-steel, which though not identical in colour or texture, would not, I am sure, offend the most critical eye.

Standards or A-frames

These are symmetrical castings, with raised beadings around the edges both front and back, and can both be made from one pattern. It would be permissible to simplify the pattern by leaving the inside surface flush, but unless two patterns were made, it would then be necessary to duplicate the weighshaft lug and the two facings (seen on the left side in the drawing) and saw off the unwanted projections afterwards.

After checking the general flatness of the pair of castings, and correcting any substantial errors in this respect by filing the edges of the beadings if necessary, they may be clamped together by bolts and plates through and across the apertures, with the edges truly in line all round. It is not necessary to do any very elaborate marking out of the castings, but a rough check of essential dimensions may be found desirable, on the general and very sound principle of taking nothing entirely for granted.

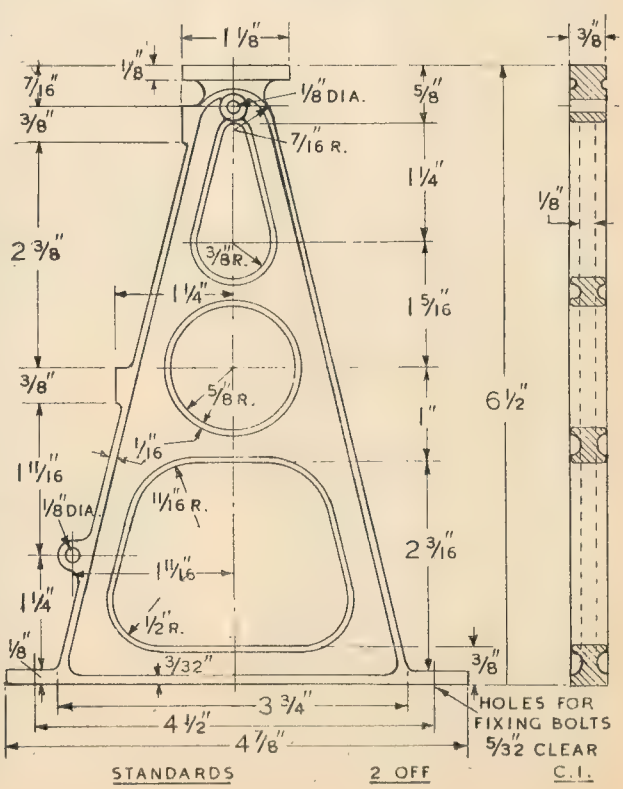
The edges of the base, bearing platform, and side facings should then be squared up accurately with the vertical surfaces, either by filing, or any convenient means of machining which may be available. It is quite easy to clamp the pair of castings on the lathe cross-slide, with suitable parallel packing of metal or hardwood to bring them to near centre height, and face-mill the surfaces with a single-point cutter.

While the castings are still clamped together, the holes for the tie-bolt and weighshaft should be marked out and drilled; the former may be spot-faced inside and out, but the latter on the inside surface only. It is advisable now to identify the individual parts to ensure that they are kept in the same relation to each other in assembly.

Beam

This is also in cast-iron, and, although it could be made satisfactorily by quite primitive methods, there is scope for taking advantage of machine tool equipment in ensuring accuracy of the working parts fitted to it. In previous articles, where I have described the machining of components having eyes, or holes bored in true parallel planes, I have always recommended that they should be set up on the faceplate on the individual bore centres; but this is clearly impossible here, unless a lathe with a much larger swing than that normally seen in a home workshop is available. It is, however, possible to mount the beam, on its main trunnion centre, across the faceplate of a 3½ in. gap bed lathe, and this is the best way to deal with the boring and facing of the trunnion seating. In setting up, parallel packing pieces may be found desirable to ensure that the beam is parallel with the faceplate, both lengthways and edgeways; these packings should be directly under the clamps to avoid bending stresses.

Having bored the centre hole, a simple



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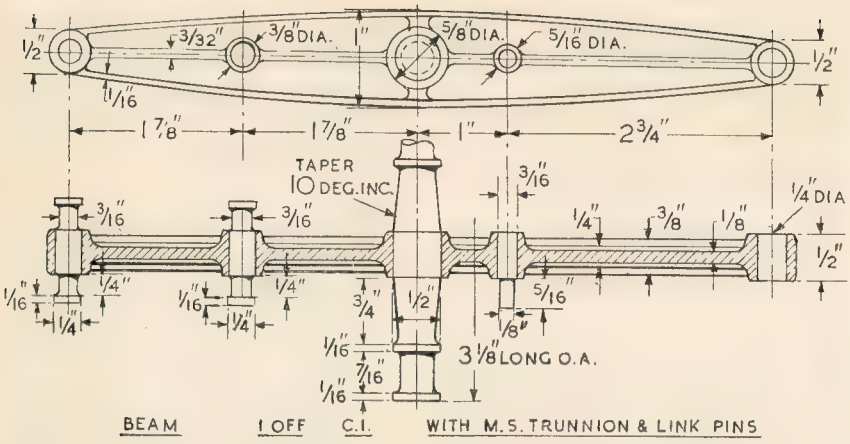


improvised jig is desirable to ensure that the other holes are bored parallel with it. For this purpose, a large angle-plate, or any other fixture which can readily be bolted to the cross-slide, and has a truly vertical face, can be utilised; it is set up with this face exactly square with the lathe axis, and a pin $\frac{1}{2}$ in. diameter, to fit the hole in the beam, is fixed in it, near the front end. A collar on the pin, or a parallel packing washer, will ensure that when the beam is clamped in position it will be positively located in the angle of its axis, though free to pivot about this centre; to facilitate clamping, the pin may with advantage be screwed on the end and fitted with a nut, as shown.

The cross-slide is now traversed so as to bring the end of the beam into position for boring; if desired, this position may be pre-set by measurement from the locating pin before mounting the beam. To do this, a mandrel of known diameter is held in the chuck or between centres, and measurement taken by calipers, slide gauge or other means between this and the pin, allowing for the radius in each case. Thus, if the mandrel and the pin are both $\frac{1}{2}$ in. diameter, the necessary distance between them to ensure the correct beam radius of $3\frac{3}{4}$ in. will be ($3\frac{3}{4}$ in. — $\frac{1}{4}$ in. — $\frac{1}{4}$ in.) = $3\frac{1}{4}$ in. "Elementary, my dear Watson!"—of course; but sound practice, just the same.

By swinging the beam up or down, it may be centred vertically, and after clamping on the locating pin, the hole is started with a centre-drill, which is fed in to produce a countersink practically equal to the size of the following drill, so that the risk of the latter running out of truth is practically eliminated. Short stubby drills are desirable for these operations—broken drills may often be given a new lease of life by regrinding for such purposes—and, in this case, it is desirable to use a drill a few thousandths-of-an-inch under $\frac{1}{4}$ in. to allow for finishing with a $\frac{1}{4}$ in. reamer. The tendency of the casting to spring under the pressure of the drill may be counteracted by lightly backing up with a pad in the tailstock.

Having bored one eye, the beam may be turned end for end and the process repeated without shifting the cross-slide; this will ensure exact symmetry of radius in the two eyes. The slide is then traversed to locate the positions of the intermediate holes, using the same methods of measurement as before, if the closest possible accuracy is desired. All the eyes should be faced on the ends of the bosses, to a uniform level; the simplest method, if the clamps can be suitably arranged to avoid obstruction, would be to set up on the trunnion centre, across the faceplate, and take a facing cut right across all the bosses; this may well be done at the same time as the initial boring operation for the trunnion seating.

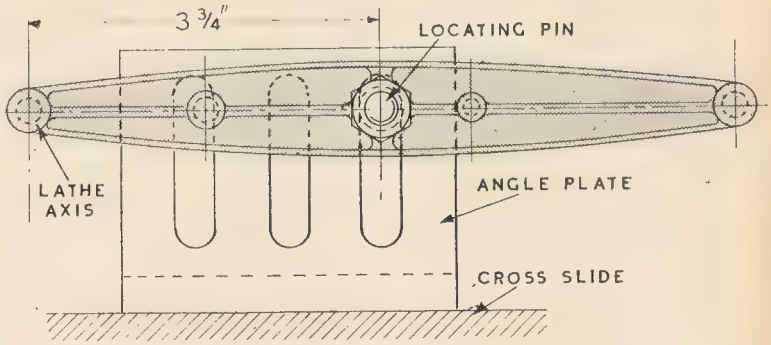
Beam Fittings

The trunnion pin, pump rod pin and link pivots are all turned from mild-steel, and made a press fit in the respective eyes. They may be turned between centres, but if so, it is not desirable to leave the centres in, and thus extra length should be allowed for facing them off afterwards. The working surfaces of the pins should be very carefully finished, and no sharp internal corners should be left; this does not affect finished appearance, as these parts do not show, but it is desirable on general principles, as good engineers do not leave sharp corners in journal bearings. On a highly stressed bearing, a sharp change of section may form a focus for a crack to develop sooner or later, and though this is not a very serious risk on an engine of this type, it *has* been known to happen.

Connecting-Rod

Once again, cast-iron is employed for this component, and although there is not a great deal of machining to be done, what there is is very important. It is advisable to provide the lower, or "big" end of the rod with extra length, besides machining allowance on all four sides; the upper, forked end may be cast to the shape shown, with allowance only for facing both inside and out. The circular beadings at the two ends of the cruciform shank should have a little left on for cleaning up in the lathe, and this may be the first operation, as it will be relatively easy at this stage to set the casting up with the forked end in the four-jaw chuck (don't forget to put a packing-piece in the fork), and the other end centred for tailstock support. For drilling this centre, an improvised steady on the beading will be helpful, to ensure that the location of the centre is correct. Both the beadings should be turned to the same diameter, and smoothly rounded off with a hand tool or file.

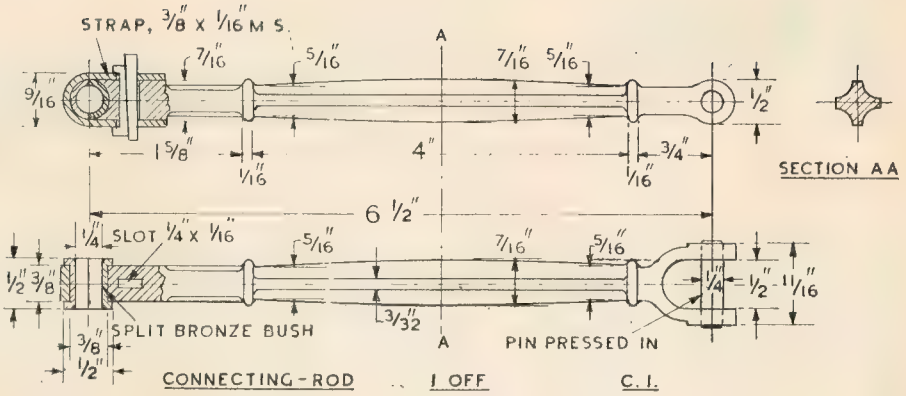
Owing to the shape of the rod, it is not easy to hold for the cross boring operations, but this difficulty can be overcome by making a simple mounting jig, using a straight piece of steel plate or rectangular bar about $4\frac{1}{2}$ in. long, with two little vee packing blocks or split bearings mounted near the ends, to form seatings for the turned beadings. The rod is clamped to this bar, with the fork set exactly square to it, and the assembly can then be mounted either on



Method of mounting the beam for boring the holes in true parallel alignment

the cross-slide, packed up to centre height, or on the side of an angle-plate, and dealt with in much the same way as the beam, with the assurance that the end bores will be exactly parallel.

The sides of the big-end can be machined to correct width by using this set-up, and by loosening the rod clamps, it can be turned exactly at right-angles to machine the other two sides, with an end-mill or face cutter in the chuck. This operation will cut away the metal surrounding the eye to a knife edge, and what little remains can be sawn through to leave the half-seating for the bearing brasses.



The Strap

In bending the $\frac{3}{8}$ in. by $\frac{1}{16}$ in. mild-steel strip to form the strap, hammering should be avoided as much as possible, as it is more likely to stretch and distort the metal than to produce a true bend. This thickness of metal can be bent by hand, using a mandrel a little smaller than $\frac{3}{8}$ in. diameter to allow for spring (a preliminary trial with an unwanted piece of the same strip will show how much should be allowed), and the strip should be pulled firmly and squarely on to the mandrel surface while bending. Any imperfection in the shape should be capable of being put right with a few judicious blows with a hide mallet, and the strap should seat snugly on the sides of the rod, with a slight inward "set" rather than side clearance.

Split Bearing

Before fitting the gib and cotter, the split brasses should be made and fitted; there are several ways of making these, but the way I do it is to rough down a piece of bronze rod in the chuck, and drill an undersize centre hole, then remove from chuck and split it endwise as truly as possible; the faces are machined or filed exactly flat, and the two halves sweated together. After re-chucking, the external and internal machining is completed and the bush parted off; in this case I recommend that the halves should not be separated until the big end assembly is completed The cheeks of the bearing should fit the strap and the end of the rod, without side play.

Gib and Cotter

The design of this type of bearing reminds me that the construction and fitting of a gib and cotter joint was once a standard proficiency test for fitter apprentices; and, personally, I think that the engineering industry would be much better off today if everyone calling himself a fitter had to prove it by some similar test. This, however, is by the way; the job in hand now is to cut the slot in both the rod and the two sides of the strap, and fit these fiddling little items, which can be made from $\frac{1}{16}$-in. mild-steel plate or strip.

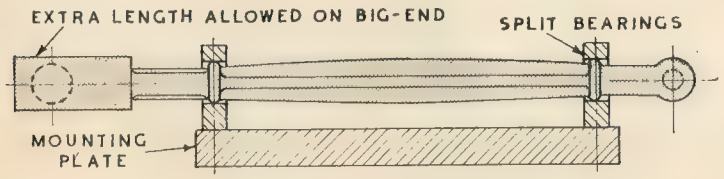
Unless one has really good facilities for end milling with tiny cutters, it will usually be found that the quickest way to cut these slots will be to drill rows of holes and join them up with a file in the traditional manner, or as an old millwright friend of mine (obviously a disciple of Dr. Spooner !) used to say, "chilling and dripping." The use of a chisel on such a small job is, however, somewhat dubious, and I suggest that the holes should be drilled with a No. 53 drill, as close together as possible, and joined up with a spiral saw blade, then slotted out with needle files. I do not know whether the special cotter files which were once made for this sort of job are still available—incidentally, they were highly efficient for all sorts of slotting jobs—but in any case it is hardly likely that they could be obtained in such small sizes as would be needed here. This operation will not please the man in a hurry, as it requires care and patience, but it should not worry anyone prepared to exercise these virtues.

It should be observed that the slots in the strap and the rod are not exactly in line; they are cut in such a way that the wedging action of the cotter draws the strap firmly against the bearings, and is, in fact, capable of taking up a certain amount of slack after the latter have been re-adjusted to compensate for wear. To locate them, in their proper relation, the strap may be put in position with a short piece of rod 11/32 in. diameter in place of the bush, and the slots in both rod and strap filed to coincide; this will give 1/32 in. "draw," which should be sufficient.

The gib and cotter are quite easy to make; they form, in effect, a pair of "folding" wedges, but the gib is made with two heads, which should fit the width of the strap exactly, and thus prevent any tendency for the latter to spread when the cotter is driven in. A taper of about 5 deg. on the contact faces of the two items will be suitable; when the two are placed in contact, the dimension should be constant (i.e. parallel) over the outside bearing surface, and both inside and outside surfaces should be square and smooth. A lot of palaver over two insignificant bits of metal, you say ?—but believe me, it is worth while to spare a bit of trouble to get these little things right !

It may be mentioned that in early engineering practice, not to mention horology and other crafts, the use of wedges, cotters and taper pins as fastenings was predominant, the reason, of course, being that they were easier to use than bolts and screws, in view of the fact that the methods then available for producing the latter were neither accurate nor efficient. In the adaptation of this design, I have not indulged in the use of gib and cotter joints more than I consider really necessary to preserve the true character of a representative "period" model, as they are extremely difficult to fit in very small sizes, and provide much less security than screwed joints.

(To be continued)



A simple jig to hold the connecting-rod for machining the ends

L.B.S.C.'s Titfield Thunderbolt

Details of the tender for both gauges

AFTER taking a good look at the drawing of the tender for the full-sized *Tit*, I've come to the conclusion that the merchant who built it must have been short of material, and lacking in bawbees as well. Apparently he went "on the scrounge" among the railway yards, found a few old sleepers, some bits of metal, and a discarded water cistern. Using a couple of the sleepers, he chawed out a pair of ragtime frames, and assembled them with a sleeper at each end. Then he found that his water cistern was too low, so he chopped up another sleeper, and put the bits between the cistern and the frame, to bring it level with the engine footplate. Unofficial history doesn't tell us where he got the wheels, but he must have gone down the coal-merchant's siding, and snaffled the brake gear off a Moger or a Stephenson Clarke. To make a space for coal, he got a hammer and chisel, and chopped a slit halfway along each side of the top of the cistern, bending the bit down until it touched the bottom, and soldering up the seams. Of course, I may be all wrong, but that's what the whole business looks like.

An Easy Job

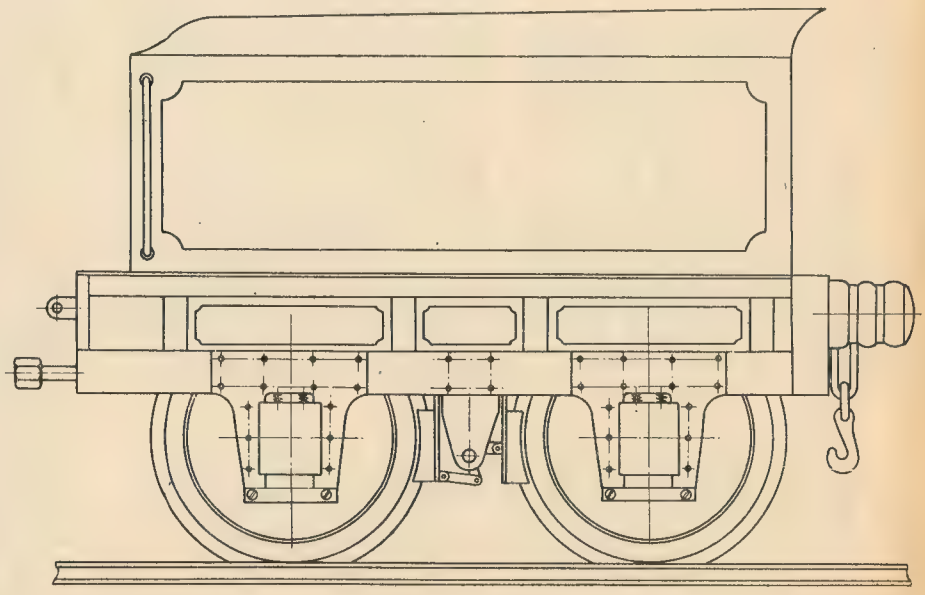
Being a lazy person myself, I've tried to make the job ever so much easier, though I've kept to the personal appearance of the original tender as much as possible. Each side frame is made in one piece, the lower edge being cut to the outline of the horn-blocks, separate hornplates of the same shape being riveted on outside, same as full-size. Friends and relations of Inspector Meticulous, can cut rectangular openings as shown if they so desire, and jam little bits of wood in them, to simulate the cross-beam supports of the tank. They can also use hardwood buffer and drag beams if they wish, fixing the side frames to them with bits of angle, riveted to the frames, and bolted to the wood; personally, I should use metal, and braze the lot solid, dispensing with rivets altogether. There isn't any soleplate, the coal plate being an extension of the bottom of the tank, the whole issue being attached to angles riveted along the top edge of the frame. Wheels and axles are normal, but there are no springs showing outside the frames in full-size; so in the 3½-in. gauge engine, I have arranged spiral springs in pockets drilled in the axle-boxes, bearing against the top of the hornblock opening, as there isn't room for springs between frame and wheels. On the 5-in. gauge job, we have a little more room to play about in, so I'm specifying overhead spring pins working through lugs on the inside of the frame, with fairly long spiral springs between lug and axlebox, as you'll see in the next batch of drawings, all being well. Incidentally, the hole shown above the 5-in. gauge hornplate, is drilled in the frame to accommodate the shank of the spring-pin lug or guide.

Pipe Connections

Another slight alteration, is in pipe connections. On not-so-big sister, the connecting hoses, or feed-bags, as they are known among enginemen, are placed very low down, and there are only two of them. On the little engines, we have extra pipes, for the injector feed, and the pump bypass; and if the whole conglomeration is placed right down close to the rails, it is not only going to be unsightly, but liable to damage as well. I have, therefore, substituted my "standard" arrangement, which is more convenient; but, of course, if anybody who is scared of Inspector Meticulous, wants to set the feed-bags low down, the best thing he can do, is to make a two-storey job of it, with the hand-pump and injector pipes just under the dragbeam as shown, and the pump and bypass pipes down in the basement, altering the connections on the engine, to suit. Well, that's enough of what the B.B.C. might call "Thursday Comment," so let's get on with the job.

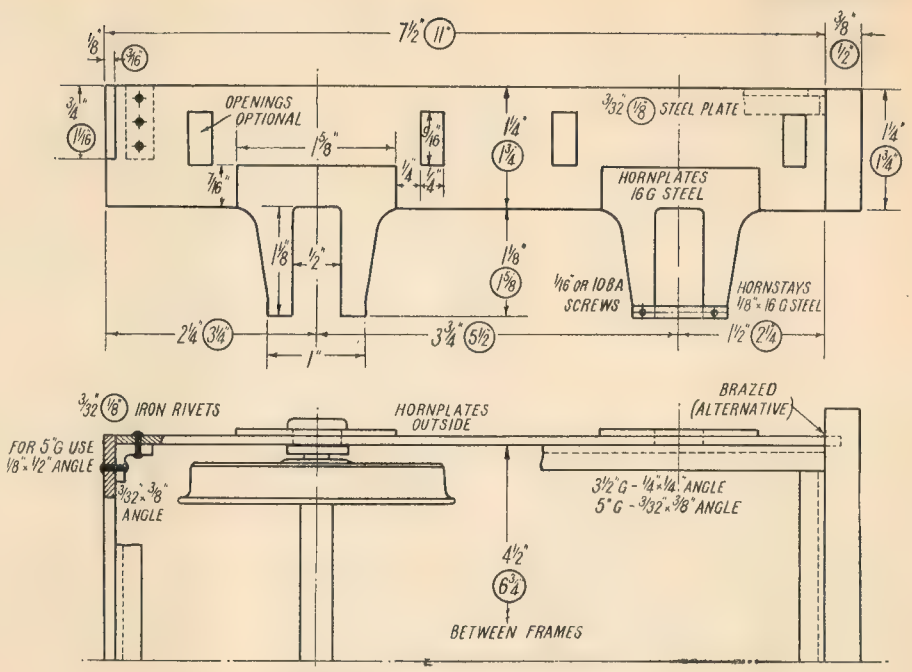
Tender Frames

The complete side-frame can be cut from sheet steel, 3/32 in. thick (13-gauge) for the smaller engine, and ⅛ in. (10-gauge) for the larger, by the same method as given for ordinary engine plate frames. The outline of the 3½-in. tender frame is shown, fully dimensioned. The outline of the 5 in. job is exactly similar, the dimensions being shown in the circles. A rebate is cut at the front end, to take the dragbeam, which doesn't extend to the full depth of the frame. The rectangular openings are optional. If cut, they can either be left open, or plugged with small pieces



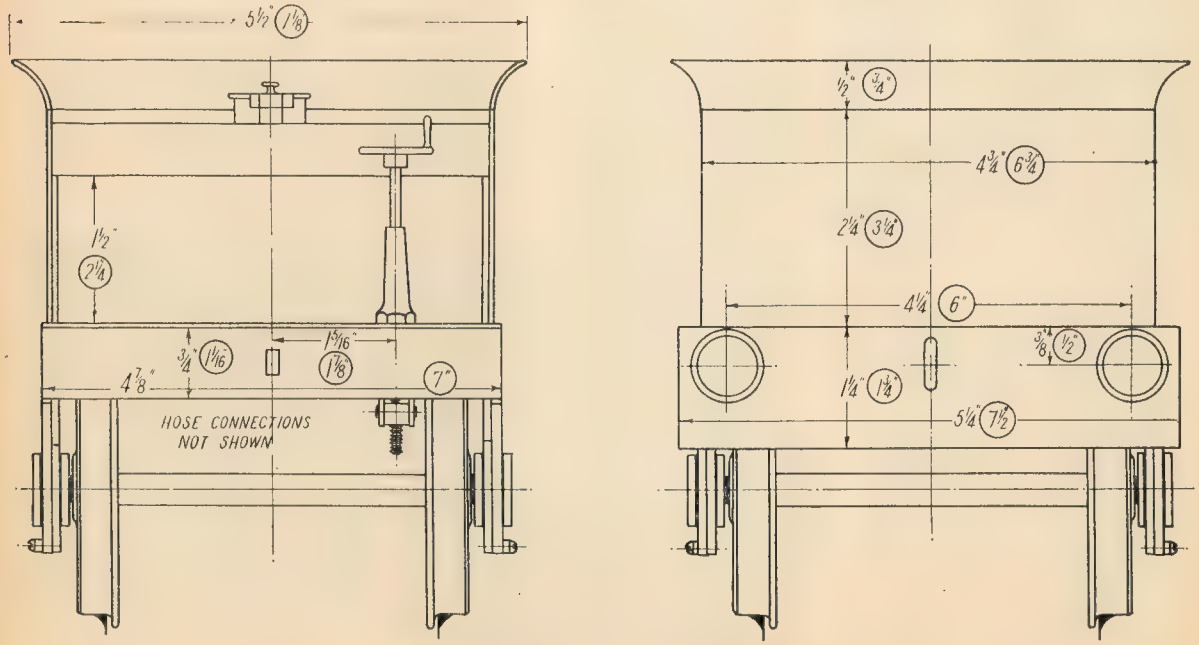
Side elevation of the tender for the "Titfield Thunderbolt"

of wood, to represent wooden cross-beams. The hornplates are cut from either 16- or 13-gauge sheet steel, according to size of engine, and riveted to the frames, on the outside, over the similar projections already formed on the frame plates themselves. This kills two birds with one shot, thickening up the frames at the points where the axleboxes are fitted, and giving the correct appearance of the hornplates on the full-size engine. To avoid any confusion in measurements of the hornplates, I have shown a separate illustration of the 5-in. gauge size; also the size and location of the rectangular opening in the frame, if desired to include them. In the 5-in. frames, drill a $\frac{3}{16}$-in. hole at $\frac{1}{4}$ in. above the centre of each hornplate, as shown. The hornstays are just strips of steel, cut to length, drilled for screws, and attached to the bottom of the hornplates by round-head screws. For the benefit of our good friends who adore pimples, I have shown the location of those attaching hornplates to frame, in the general arrangement of the tender. Use $\frac{1}{16}$-in. rivets for the smaller engine, and 3/32-in. for the larger.

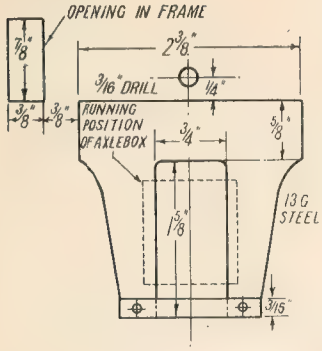

OPENINGS OPTIONAL
STEEL PLATE
HORNPLATES 16 G STEEL
HORNSTAYS 1/8" × 16 G STEEL
1/16" OR 10BA SCREWS
IRON RIVETS
HORNPLATES OUTSIDE
BRAZED (ALTERNATIVE)
FOR 5" G USE 1/8" × 1/2" ANGLE
3/32" × 3/8" ANGLE
3½" G - ¼" × ¼" ANGLE
5" G - 3/32" × 3/8" ANGLE
BETWEEN FRAMES

Elevation and plan of the tender frames

No separate drawings are shown for the dragbeam, or bufferbeam, as the dimensions are given in the side and end views. The dragbeam is just a plain piece of metal fitting into the rebate cut at the front end of each frame, and is either attached by angles and rivets, as shown in the plan, or brazed. If wood is used for the bufferbeam—I certainly don't recommend it, but some good folk may fancy a wooden beam—use good hard stuff, something that won't warp or split, and plane it exactly to size. The angles may be attached to it by round-head or countersunk screws, put through clearing holes in beam and angles, and nutted inside. The frame can either be riveted to the angles, or screws may be used. If a steel beam is used, it can be attached to frames like its mate on the engine; but if I were



Front and back views of the tender



Hornplate for the 5-in. gauge version

doing the job personally, I should just assemble the whole bag of tricks, beams and frames, and give all four corners a dose of my old pal Sifbronze. Slots could be cut in the bufferbeam, as indicated by dotted lines in the plan, and the frame-plates squeezed into them, whilst the dragbeam could be held in place by steel screws put through clearing holes in the beam, close to the edge, into tapped holes in the thickness of the plates. One in each joint would be ample, the heads being filed off after the Sifbronzing or brazing had been completed. When fixing up a *Tich* frame by this method, I just put two bits of rod, screwed at each end, through the holes in the beams for the buffer shanks; and a nut on the outside of each, held the lot quite secure while I operated with the Alda blowpipe. Warning: I told a correspondent who was building *Tich*, about this stunt, and he said he would do likewise. He did —but made the mistake of screwing up the nuts too tightly, in an effort to hold the lot rigid. When the blowpipe was applied, and the ends of the frames, at the joints, became red-hot and flexible, they just distorted under the pressure of the nuts; and the resulting frame assembly was just the reverse of a true rectangle, looking as though each end had received a severe side swipe. He managed to true it up by judicious use of a hammer, and a square steel bar held in the bench vice, but it was a job which would have been avoided by merely having the nuts tight enough to prevent the frames slipping, and no more.

It would be a good wheeze to leave the axlebox slots in both frames and hornplates, a wee bit under full width; then after the hornplates have been riveted on, the frames can be clamped together, and the slots trued up to correct width with a flat file, a bit of bar, of width shown, being used as a gauge. It should fit easily, but not too slack. Leave the top corners very slightly rounded. No staying is needed, as the frames cannot move, once the tank is attached; and for this purpose, pieces of brass angle should be riveted for the full length of sides and ends, level with top of frames, as indicated.

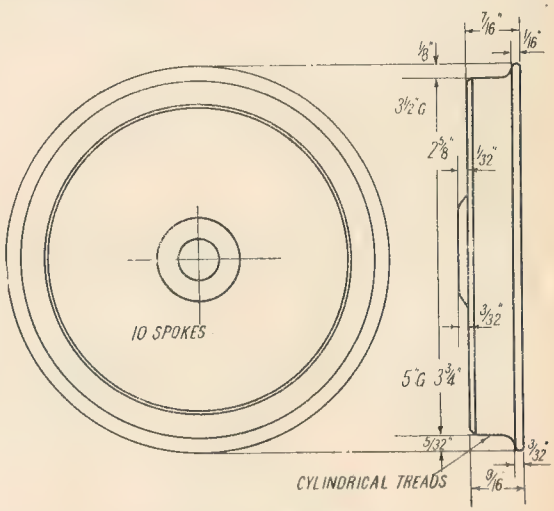
Axleboxes for 3½-in. Gauge Tender

The axleboxes for the 3½-in. gauge size, differ slightly from those on the larger tender, so I have shown the former separately, and will include a drawing of the 5-in. boxes, plus assembly and erection details, in the next spasm, all being well. The smaller ones can be made from a piece of $\frac{3}{8}$ in. × $\frac{5}{8}$ in. bronze or gunmetal bar, which may either be drawn or cast; if the latter, smooth it up on the outside before machining. If a milling machine is available, it is just a kiddy's practice job to mill a groove, 5/32 in. wide and $\frac{1}{16}$ in. deep, for the full length of the piece of bar; this should be $\frac{1}{16}$ in. from the edge, as shown in the plan and side views. The job can also be done with equal ease, on a planer or shaper, with a parting-tool, 5/32 in. wide, in the clapper-box. If only the lathe is available, just resort to the old familiar stunt of clamping the bar on its side under the slide-rest tool-holder, and traversing across a 5/32-in. end-mill or slot-drill held in the three-jaw.

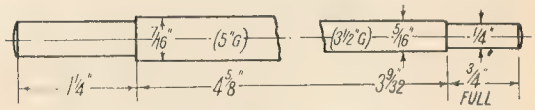
Either part off the four $\frac{3}{4}$ in. lengths in the chuck, or else saw to full length, and then face to dead length by chucking each sawn piece separately. Mark off and drill the holes for the axles, being careful to get the centre-pop, which should be heavy, slap in the middle. Use either a drilling-machine, or the lathe, with the drill in three-jaw, and the box held against a drilling-pad in the tailstock barrel, as the hole must be dead square with the face of the box. Incidentally, I've found the grooved drilling pad that came with the supersonic Myford, mighty handy indeed; for although I have a big pillar drill and a small sensitive bench drill, with vee-blocks, machine-vices, and what-have-you, it always requires careful sighting, to drill round stock clean through what one of my young friends calls the "miggel." The Myford grooved pad automatically locates the said "miggel" bang in line with the drill in the three-jaw; and the ball-thrust three-start-screw feed, sends the drill through like pushing a pin through some soft cheese. By the time I'm through, I shall have to thank Bro. Myford for an extra lease of life !

Use a ¼-in. drill for the job, and be careful to avoid going right through. The next job will be the holes or pockets for the springs; these are drilled 9/64 in. or No. 27, and are 7/32 in. deep. A $\frac{1}{16}$-in. hole can be drilled down from the top of the box, into the axle hole, for oiling purposes; countersink the top. Round off the edges of the boxes on the outside, and slightly round off the top of the grooves at each side, to correspond to the rounded corners of the slots; this will prevent the boxes accidentally jamming at the extreme top position, should the tender sway or lurch when running over a bit of rough road, or through point switches and crossing frogs. Each box can then be fitted to the horns, and marked, so that it can be replaced correctly at any future time. The springs are wound up from 20-gauge tinned steel wire, a job I have described many times; they should just start to compress when the box is at the bottom of the hornslot. Final adjustment can be made under load.

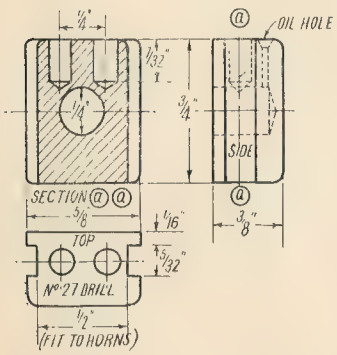
(*Continued on page* 544)



Details of the wheels



Axles for both gauges



Axlebox for the 3½-in. gauge version

Ten efficient substitutes for two eyes

Versatile Tools

By R. H. B. Thomson

IF the question "What is the power that has raised man from the status of a brute-beast to the position of almost 'lord of all he surveys'?" were posed to a cross-section of the public (that term so beloved of the statistician) probably the larger part would answer: "Man's facile brain." But I think engineers would answer as one man: "Of course, his remarkably clever hands."

It is beyond question that civilisation could never have assumed its present proportions *without* those hands. A nimble brain conceived, say, the watch; but from the very birth of the idea, the hands took charge—from the setting down on paper of the design and details, throughout the making of the watch to its winding and regulating.

Skill in the use of these ten versatile finger-tools is not a sort of masonic secret—it can be acquired by anybody; but how often we meet the man who says: "I can't even knock in a nail!" What a waste of a gratuitous tool-kit!

What a grey world it would be without the arts. Here again the hands play a very full part. The hands of a Stradivarius made the violin; the fingers of a Kriesler conjures the melody from the strings. Wonderful tools, these hands of ours!

And the pity of it is that, like other good tools, too often are they subjected to gross mis-use. A knife in the sensitive fingers of the surgeon can put a life on to the credit side of the book; the dexterous fingers of the pick-pocket can separate the unwary from their wallets. An oxy-acetylene outfit in the hands of one of our fraternity can produce, say, a useful boiler; a similar outfit in the nefarious hands of the burglar can open a safe.

The things we use every minute of our existence—clothes, furniture, travel, the houses we live in, money, the machines we use, much of the food we eat—the list would be unending—are the product of man's hands. If the stickler for hair-splitting accuracy says: "But, much of what we use is made by machines," I would counter with, "Well, and what made the machines—or the machines that made the machines?" Ultimately we get right back to the *hands*.

A friend of mine, in his earlier years, was an engineer on a tug-boat. He went to the first world war, and when he came back . . . he went to St. Dunstan's. There he learned cabinet-making (strange tools for a marine engineer). I can assure you that a walk around my friend's house, inspecting the furniture he has made, is in itself an education.

During the second world war he was an inspector in an aircraft factory. Equipped with a blind person's micrometer (and vernier at that), a vernier height gauge, *and his ten fingers*, there he was, this sightless man, accepting or rejecting the work of men with two perfectly good eyes.

After the war he had a crack at wood-turning as a hobby. Gentlemen, how many of *us* could go to our workshop on a dark night, no lamp lit, set up a chunk of wood in the lathe, and get to work on it with chisel and gouge?

So successful was he with wood-turning—and bucked as well!—that he decided to get a real engineer's lathe—screwcutting, back-geared, and with all the trimmings. His love, of course, is steam; his first job was a Stuart No. 4 vertical engine—you may have seen it at the "M.E." Exhibition. His next? Two more small ones, and then a 4 ft. 6 in. *Zwarte Zee* tug. His difficulty, of course, is the drawings. So a friend will explain the details and measurements, which he then puts into Braille (as are also his relevant engineering tables—tapping drill sizes, etc.).

Having read this, possibly you will say: "Well, he's got what it takes!" Yes, and what a testimonial for hands! All his courage and determination (and, remember, there are thousands like him) would have produced nothing tangible had he not discovered, and put to good use the latent craft that lay in his own two hands.

When we have laboured long and assiduously in our little back-yard workshops and have produced a piece of work that has given us pleasure in the making, and perhaps a pardonable pride when we contemplate the finished job on the bench, we may be apt to assign the credit to—and think affectionately of—our bits of plant. . . . "Good old lathe, good old drilling-machine," our little hoard of taps, dies, files and what-have-we; and a-many of us have thought that the sacrifices we have had to make in order to acquire them have been well worth-while. But should we not give the larger meed of praise to those ten tools that cost us not a red cent.—those maids-of-all-work, in pursuit of our hobby always filthy, frequently lacerated, very-much-taken-for-granted "bunches-of-fives"?

"Now, let's see . . . . ."

A Camera Bench Stand

By "Dioptre"

WHEN photographing models or other products of the workshop, either for record purposes or for reproduction in the press, it will usually be found an advantage to have the camera mounted on an adjustable stand, so that both the camera and the object photographed can rest stably on the same bench or table.

In this way, composing the picture on the focusing screen and, at the same time, bringing the image into exact focus are greatly facilitated; moreover, any shaking of the floor occasioned by passing traffic will then affect both the object and the camera to an equal extent. This is akin to the procedure adopted in micro-photography, where the optical bench carrying the object, the microscope, and the camera is slung in rubber bands.

On the other hand, the usual tripod stand has the disadvantages that it often lacks rigidity and, when one leg is moved, the camera itself will necessarily move in two directions.

For the kind of critical photography undertaken in the workshop, it is essential that the camera should have a ground-glass screen in order to bring the image into sharp focus and to compose the picture to the best advantage. The old-time wooden, quarter plate, stand camera is ideal for this work, and with present craze for miniature cameras with large lens apertures, the more humble kind of appratus can often be bought for a few shillings.

There is, however, one feature of these simple cameras that makes for more convenient working; this is termed triple-extension and means that the back of the camera carrying the plate can be moved independently with a rack and pinion gear for focusing the image on the screen. On the other hand, with a double-extension camera, where only the front or lens panel can be racked in and out, it may be found impossible in close-up work to obtain a focus, and instead, the camera itself will have to be moved nearer to or further from the object. With its greater range of movement, the triple-extension camera will usually enable an object to be photographed at twice full-size, but this may amount to no more than full-size with the double-extension camera. The camera stand illustrated in Fig. 1 is designed to afford the two cardinal movements of tilt and swing or traverse for aligning the camera on the object, and the essential movements for altering the relationship between the lens and the plate are, of course, embodied in the camera mechanism.

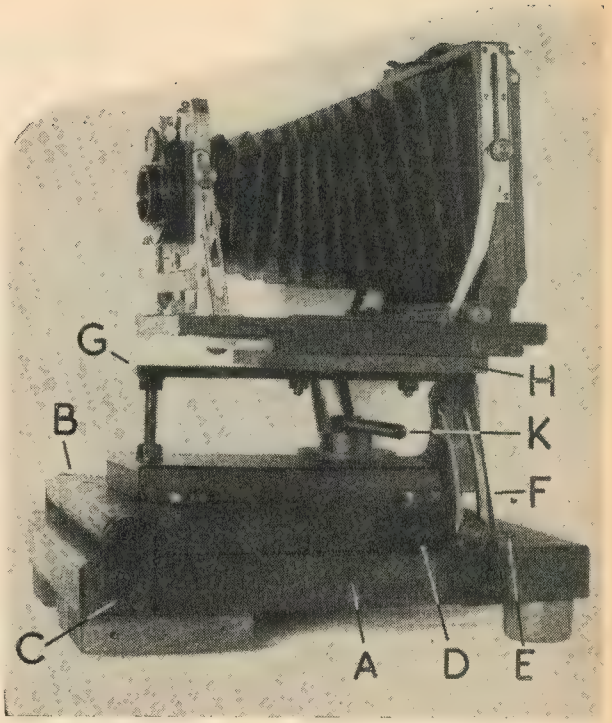


Fig. 1. The finished camera stand. A—the baseboard ; B—the tilting table ; C—the pivot brackets ; D—the table clamp-plates ; E—the locking screws ; F—the quadrants ; G—the cradle ; H—the camera baseboard ; K—the cradle locking lever

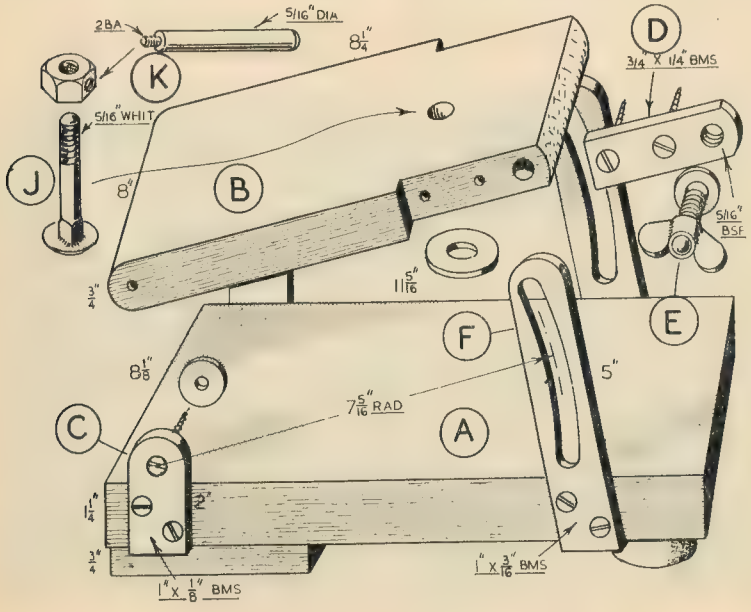


Fig. 2. Exploded view of the stand components

To form a solid foundation, the baseboard *A* was made of 1½ in. oak, and for the tilting table *B* ¾ in. oak was used. The front end of the table pivots in two small brackets *C*, attached to the baseboard, and 1 in. wood screws will serve for the pivots themselves. At its rear end, the table is furnished with two flush-fitted plates *D* to carry the wing-screws *E*, which lock the table to the two quadrants *F* after the tilt has been adjusted. Rubber door-stops were used for the three feet on which the baseboard stands.

In the stand illustrated in the photograph, the cradle carrying the camera consists of an iron casting, designed originally to serve as the base of a drilling machine.

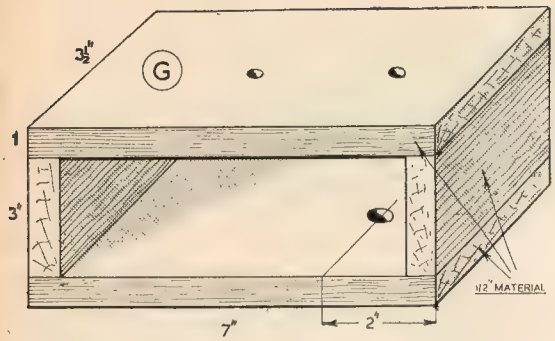


Fig. 3. The wooden cradle for mounting the camera

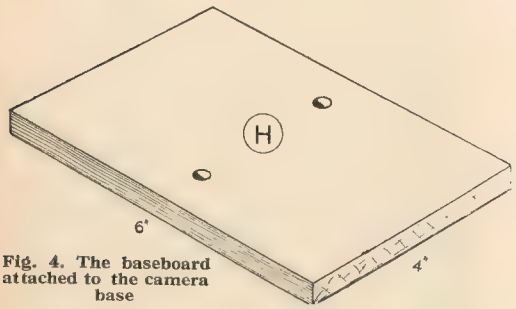


Fig. 4. The baseboard attached to the camera base

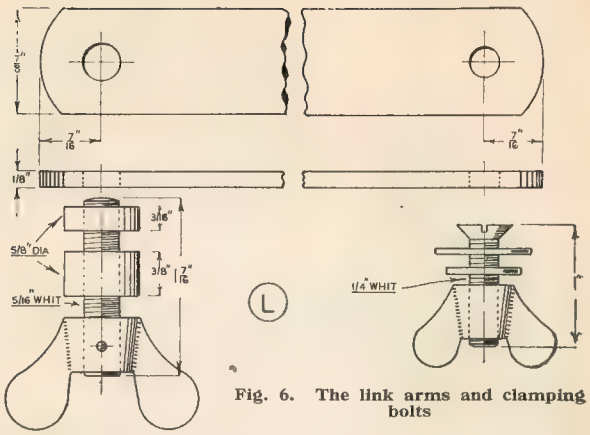


Fig. 6. The link arms and clamping bolts

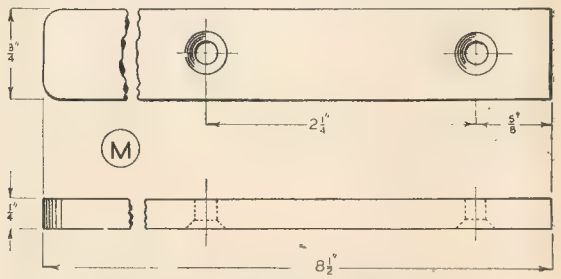


Fig. 7. The baseboard extension arms

This part was used, as it seemed right for the job and happened to be available, but the cradle can quite well be of wooden, built-up construction, as shown in the drawing.

To enable the camera to be swung from side to side, the cradle is mounted on a pivot-bolt *J*, passing through the tilting table and furnished with a nut and clamping lever *K* for locking the cradle after adjustment.

If the camera is attached to the upper member of the cradle by means of a ¼ in. Whitworth screw engaged in the standard form of camera bush, it is advisable also to fix the front end of the camera base to the cradle, in order to ensure a rigid mounting.

With the arrangement shown in the photographs, a mahogany base was secured to the base of the camera with four small wood screws, and the assembly was then clamped to the bar of the metal cradle with two ¼-in. bolts.

Where screws are inserted in the actual camera base, care must be taken not to interfere with the working of the camera base slides; incidentally, attaching a subsidiary base to the camera increases the rigidity of the mounting.

This completes the construction of the camera stand and it will be seen that, by slackening the wing-screws *E* and the clamp lever *K*, both the tilt and the swing of the camera can be adjusted to position the image correctly on the focusing screen.

For some work the camera may have to be used in the vertical position, as illustrated in Fig. 5.

The distance of the lens from the object and of the lens from the plate can then be adjusted by means of the camera base slides, if the camera is of the triple-extension type. To photograph an object at a greater distance, the camera stand can be raised on blocks, or books can be used for the purpose.

To enable the camera to be tilted into the vertical position, the extension arms *L* are used to connect the two quadrants to the plates *D* fitted to the tilting table.

However, in this position, the camera will be out of balance and will tend to fall forward; so to maintain stability, the two extension arms *M* are secured to wooden strips attached to the under side of the baseboard.

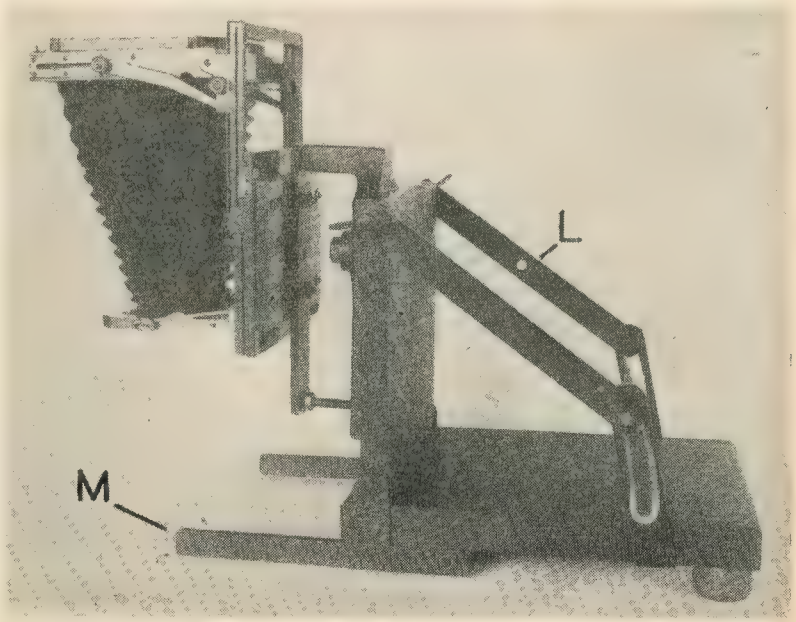


Fig. 5. Showing the camera mounted vertically. L—the link arms ; M—the anti-tipping arms

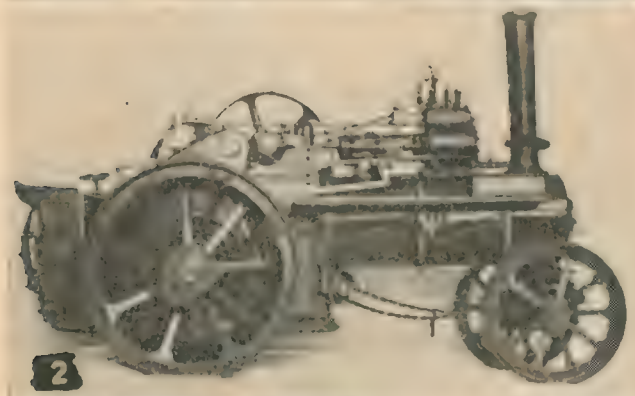
Focus on Readers' Work

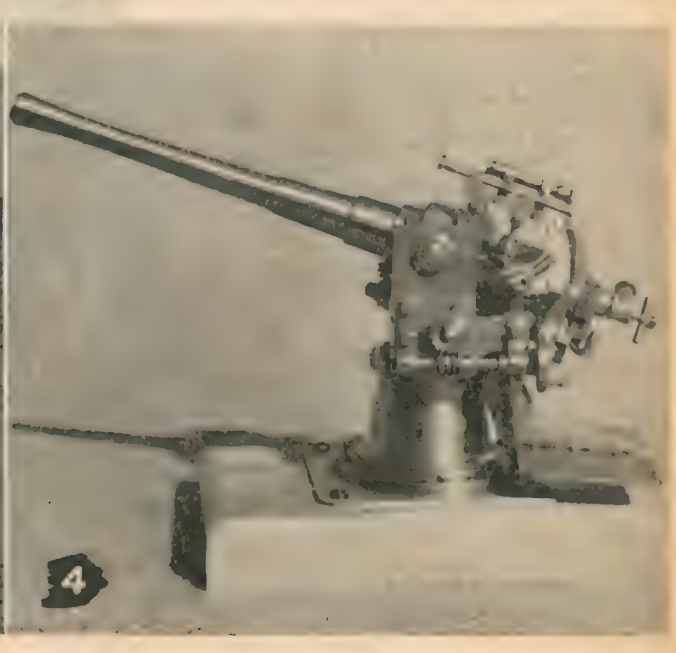
AFTER the veritable feast of model-making represented by our recent exhibition, the proud little collection presented here may serve as a tasty "savoury." Few of us ever tire of seeing the results of infinitely patient creative effort. . .

Look at the lovely, nostalgic stern-wheeler in Picture No. 1. This represents three years of purposeful leisure on the part of Mr. C. G. Rattray. Mr. Rattray retired from work as an electrical engineer eight years ago, but decided on steam for the motive power of this clean-lined model, using a twin-cylinder engine and multi-tube boiler. Exhibited at the 1952 "Model Engineer" Exhibition, the boat was highly commended. It has hand and mechanical feed pumps.

A make of traction engine which seems to escape the full glare of publicity in model-making, is the Ruston and Hornsby, but at least one model-maker—Mr. G. W. Cox, B.Sc., A.M.I.Mech.E.—has remedied this deficiency, in this case with a splendid 1¼-in. scale job (Photo No. 2). Total building time amounted to 5,500 hours, and the model has done 47 hours running. The partly-completed model was described in THE MODEL ENGINEER dated June 17, 1948. Vintage of the prototype is *circa* 1922.

Photograph No. 3 shows a workmanlike and gleaming example of a Peckett saddle-tank locomotive. Built by Mr. Applewhite, secretary of the Burton-on-Trent Model Engineering Society, it runs on 5-in. gauge track—very efficiently and without fuss, we are told.





Your Contribution

Photographs of readers' work are always of interest to others. We would therefore welcome your contribution to this page. All photographs published are paid for at our usual rates.

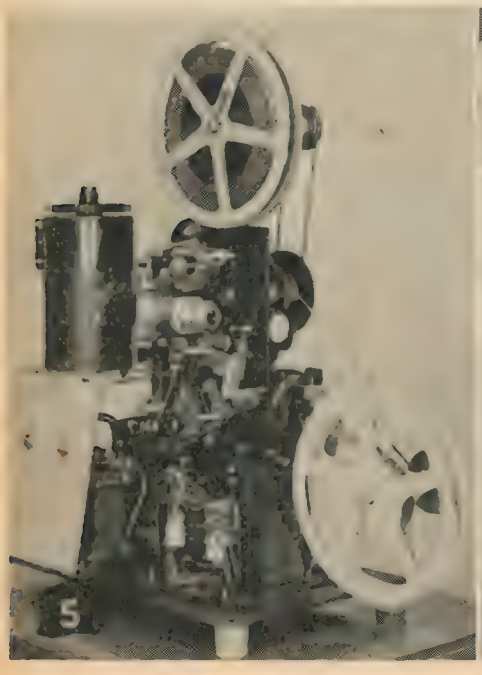
The small-scale replica of any piece of armament is always of the greatest interest, and Photo No. 4 shows a model which has the appropriate sinister, alert look of the prototype. Made in 1929 by Mr. S. Cook of Sidmouth, it is a six-inch quick-firer of about 7 in. in length, and was made from scrap, in about six months of "odd moments." Shows what *can* be done !

Another "scrap model" (some scrap, some model !) is featured in No. 5. It is a 16 mm. projector made by Mr. J. H. E. Chapman, of Louth and embodies ex-fan motor, lamp-holder made from car-starter casing and two transformers (one for future sound).

Something for the boat lovers, so that they will not feel neglected. A pleasant little salvage tug (No. 6) modelled by a young man called W. M. Barnes, who took a second prize in the Junior Class at the Northern Models Exhibition earlier in the year, with this piece of craftsmanship. Built to $\frac{1}{8}$-in. scale, it is neat and clean—almost too clean, unless she represents one that had just had a refit !

One for I.C. engine enthusiasts too. No. 7 illustrates an Atom V. 30 c.c. petrol engine with Atom R type carburettor. Castings for this job, built by Mr. F. H. Trudgeon, of Birmingham, were supplied by Craftsmanship Models Ltd. We imagine those twin exhausts speak louder than words. Considerably louder . . . Incidentally, the fuel tank is not visible in this view but is on the far side of the magneto, and is neatly mounted.

Finally, in Photograph No. 8, we are able to gaze upon an example of virtuosity in the field of tools and workshop appliances, which always have the added advantage that they can subsequently be made to work for their living, so to speak. It is the work of Mr. E. Hinchcliffe, of the Rochdale Model Engineering Society, and won for him an award as second prize winner in Class 14 in the 1954 Northern Models Exhibition. As an example of precision vertical slide and dividing attachment, it has a great degree of merit.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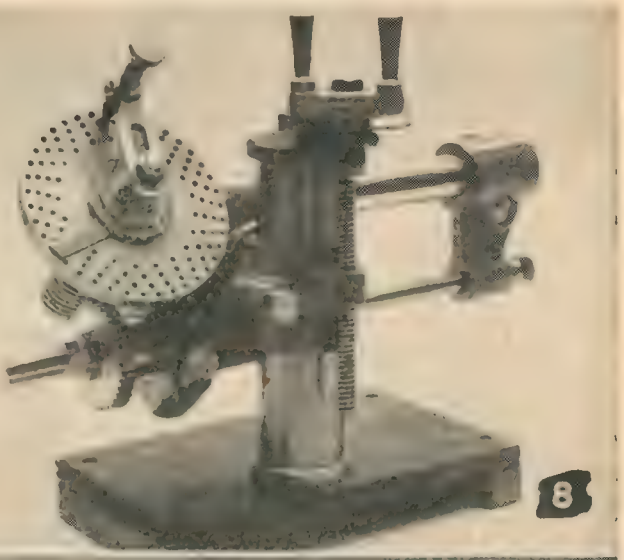

8

A Model Steam-driven Stern-wheeler

By R. W. Maynard
(Cincinnati, Ohio)

The completed model of the stern-wheeler " Omar " in " dry dock "

A FEW years ago, in a letter describing a steam harbour tug, I also mentioned another model under construction, a stern-wheel Western River towboat. After five and a half years of intermittent work, this model is finished. I've always had a love for the Western River type of steamboat, either side-wheeler or stern-wheeler; it is an American institution that is dying out, never to be replaced. There have been no new stern-wheel boats built since 1940, the steamer *Jason* being the last. The trend these days is toward the diesel-powered " egg-beater " propeller-driven type of towboat.

In spite of all the hoop-la accompanying the entry of the diesel, the records set for speed and power by steam have not been surpassed; in fact, not even has the best of the diesels been a good second. However, in all fairness, I suppose if it were not for the diesel, a lot of towboat companies would have folded up, due to increased operating costs of steamboats. It is difficult for me to be fair in this particular discussion, as my feelings are all on one side.

I wanted to build a model of one of the best modern stern-wheel boats, and to my way of thinking, I did pick the best one. I could start an argument right here for saying a thing like that. The steamer *Omar*, owned by The Ohio River Company, has a reputation for being one of the best boats of its type on the Ohio River. Built in 1936, it is the most modern design available, coupled with the fact that the men who designed her profile knew just what a good-looking river stern-wheeler should look like. The prototype of my model is 169 ft. long, 34 ft. 6 in. beam, and draws 5 ft. of water. The hull was constructed by Dravo Shipbuilding Corp., at Neville Island Pa., and the superstructure was added by the Ohio River Company at Huntington, W. Va. The engines, of 1,100 h.p., are tandem compounds, 16 in. × 32 in. × 96 in. and were constructed by The Marietta Manufacturing Company, Point Pleasant, W. Va. Originally, *Omar* had five return-flue Western River boilers, but she was reconditioned in 1948, and these were replaced with one Babcock & Wilcox water-tube boiler. As *Omar* earns her living as a coal boat, it is needless to say she is a stoker-fired coal-burner. The *Omar* holds the record for the largest tow on the upper Ohio River, having pushed 28 loaded barges from Huntington W. Va. to Cincinnati, Ohio. This tow was 1,100 ft. long, and

This photograph gives a good impression of the realistic appearance of " Omar " in her natural element

totalled almost 27,000 tons of coal. This boat also has the reputation of having moved more coal than any other boat in the world.

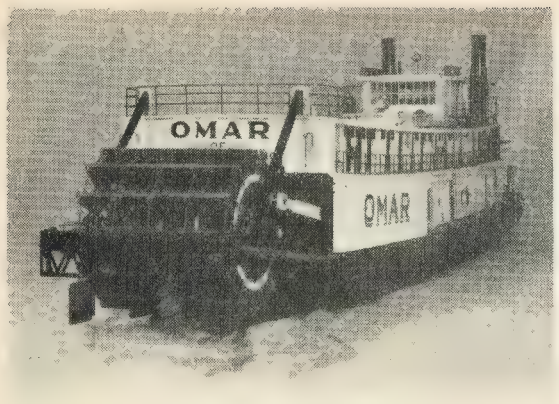
In constructing a stern-wheeler, my first intention was to make a boat which I could enjoy running. I did make a boat that would run, but somewhere along the way I found that going into detail was just as much to my interest, and I am afraid the detail won out. The model will run, but because of the fragile detail, it is doomed to spend most of its days in a glass case. I have never actually counted the number of pieces, but I'm sure it would run to over 6,000. The actual number of pieces in the paddle-wheel have been counted, and they number 1,257. In spite of this, it has proved quite strong and able to take a few not too hard knocks.

Right—A close-up of the boiler and blow-lamp

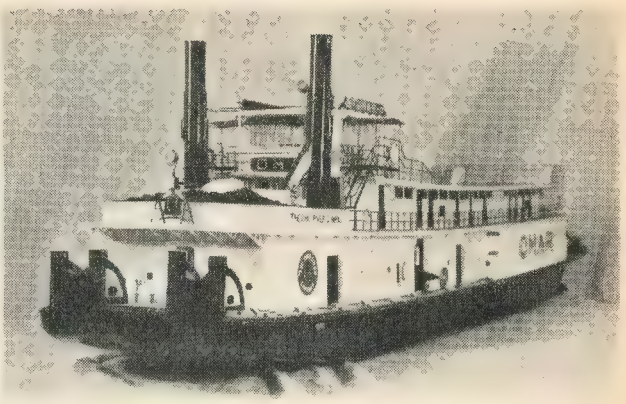
Hull with superstructure lifted off to give a complete view of steam plant

Right—A close-up of the stern paddle-wheel

The hull of the model is of 28-gauge sheet steel; I prefer steel to wood for hulls, as it entirely eliminates all dangers of cracking and warping. A wooden form was made, and separate strips hammered and twisted to shape, relieved of all strain, then soft-soldered together. The superstructure is of 3/32 in. white pine, with all sheet metal parts either of brass or aluminium. All railings and piping are of soft copper wire. Deck fittings are made of brass and aluminium. Screens are fitted to the screen doors, the screen being fine brass strainer gauze, oxydised to produce the black colour. All fittings were made at home in the workshop, the only purchased parts being standard screws, paints, chain, and the steam gauge.



The complete boat, viewed from the stern end



Another view from the reverse position, showing the bows

It Had to be Steam!

In the matter of practical application of a power plant (and it had to be steam, for wasn't this the model of a steamboat?), I did find it necessary to deviate from scale. I made the engines of simple expansion type instead of tandem compounds, using a piston valve instead of poppet, and I decided against the use of a reverse gear. The bore and stroke of the engines is ½ in. by 1⅞ in. The boiler is of the conventional single-flue Scotch marine type, with the stacks run through a sliding door in the side of the superstructure. The boiler is of all-copper construction, and is silver-soldered together. It has a 20-g. shell, 16-g. ends, and a centre flue of 16-g. The 20-g. shell may sound a little thin, but it was necessary to keep the weight down. The operating pressure is 50 lb., and the boiler has been tested to 150 lb. hydraulic test. At this working pressure, which is more than enough for scale operating speeds, the boat has enough power to overcome the winds which prevail upon our operating lake. In full size, these steamboat engines turn up about 18 to 22 r.p.m., but on the model I find it runs better if speed is increased to about 30 r.p.m.

Dimension of Model

The length of the model overal is 47½ in., with a beam slightly over 8 in., and it stands 11½ in. high; the weight is 11½ lb., and the scale is 15/64 in. to the foot. I'll bet some modellers really pull their hair out on that one, but like all things, there is a reason. When I received the photostats of the blueprints, which were drawn to scale, the photostat company had reduced the size of the prints to get them on the size of paper they had in stock, so in order to make it easy to work, I simply made my model to twice the size of the prints and it came out to 15/64 in. to the foot. I realise now it wasn't the smartest way of doing things, but then it is a little late for reflections in view of the fact the model is finished; its launching date was June 28th, 1953.

I would like to give credit for the great amount of assistance given to me by Mr. J. A. Deye of The Ohio River Company. It was through his efforts that I received the photostats of the original blueprints of the *Omar*, and he also made possible the trips I have made on the *Omar* to take photographs and make sketches for the details not covered on the prints.

Now that *Omar* is finished, my good wife and I have quite a problem. We have a large model, with a still larger case; totalling 5 ft. in length, standing 20 in. high and 16 in. wide, tipping the scales at 65 lb.; and we are living in a three-room apartment! Our seams are already opening up from five ship models, two railroads (my wife works on them), and a ¾ in. scale live steamer *Tich*, together with a couple of hundred feet of track. However, no one seems to mind as long as all the railroads and all the ships are run by steam.

[Editorial Note: Our readers can hardly fail to note that our American friend has produced in *Omar* an outstanding example of the type of model which, in many ways, is the most satisfying. That is to say, it is accurate enough in all external details to deserve a place in a museum, yet the internal arrangements and the driving machinery have been planned and built in such a way as to ensure that, when in her native element, *Omar* performs in a thoroughly, if not quite perfectly realistic manner. There is not the slightest reason why any type of working model could not be built with the same two basic desiderata in mind. All that is necessary is a little careful planning before the actual construction is begun, especially when the model is of an old-time prototype, backed up by unhurried constructional skill, regardless of the facilities available.]

L.B.S.C.'s TITFIELD THUNDERBOLT

(*Continued from page* 536)

Wheels and Axles

There was a discrepancy between the photographs and the drawings that were kindly sent to me by Mr. Riddles. In the photographs the tender wheels appear to be smaller than the trailing wheels of the engine; but in the drawing, they are shown the same size, viz.: 3 ft. 6 in. in diameter. Both drawing and photographs show ten spokes, whereas the trailing wheels of the engine have eleven spokes. I don't know whether our approved advertisers will make a fresh ten-spoked pattern, but if they don't, it won't matter a bean; the running of the engine won't be affected, which is the main consideration—with your humble servant, anyway! The drawing shows the dimensions for both the 3½-in. and 5-in. gauge tender wheels, and as they are machined in exactly the same way as the trailing wheels on the engine, there is no need to waste space by repeating the rigmarole. Ream the bosses ¼ in. or ⅜ in., according to gauge.

The axles can be turned from ordinary drawn or rolled mild-steel, of the sizes indicated in the drawing; a simple turning job with the rod held in the three-jaw. As long as the rod runs in the chuck with no appreciable wobble, a couple of thousandths or more, out of truth, doesn't matter, as the wheel seat and journal are turned at the same operation. Tip: turn the journal part so that the wheel just goes on by hand; bring the cross-slide handle back half-a-turn, advance it again until within one division of its original setting, and finish-turn the wheel seat, which should give the correct press fit. If too tight, it's a safe bet that the boss will split.

Both wheels can be pressed on each axle right away.

RADIO-CONTROL FOR ENGINE-DRIVEN BOATS

By J. Gascoigne

UNTIL now it has been a losing fight at every "radio-control" regatta for the engine-powered boat—all honours going to the electrically driven craft for "control." At the touch of a button the selector switch in the boat goes round to the desired position and circuit after circuit is made for port, starboard, forward, stop, reverse and any additional controls required. How different for the man with a diesel, petrol or steam-driven boat!

Last year, at the I.R.C.M.S. Regatta at Southend, I had proportional steering only fitted. When in discussion with their secretary, I said that I thought that engine-driven boats should have some consideration over electrically-driven ones in "control" competitions. His reply was that he considered that the basic consideration in all competitions should be the realistic control of the model relative to a full-size boat or ship.

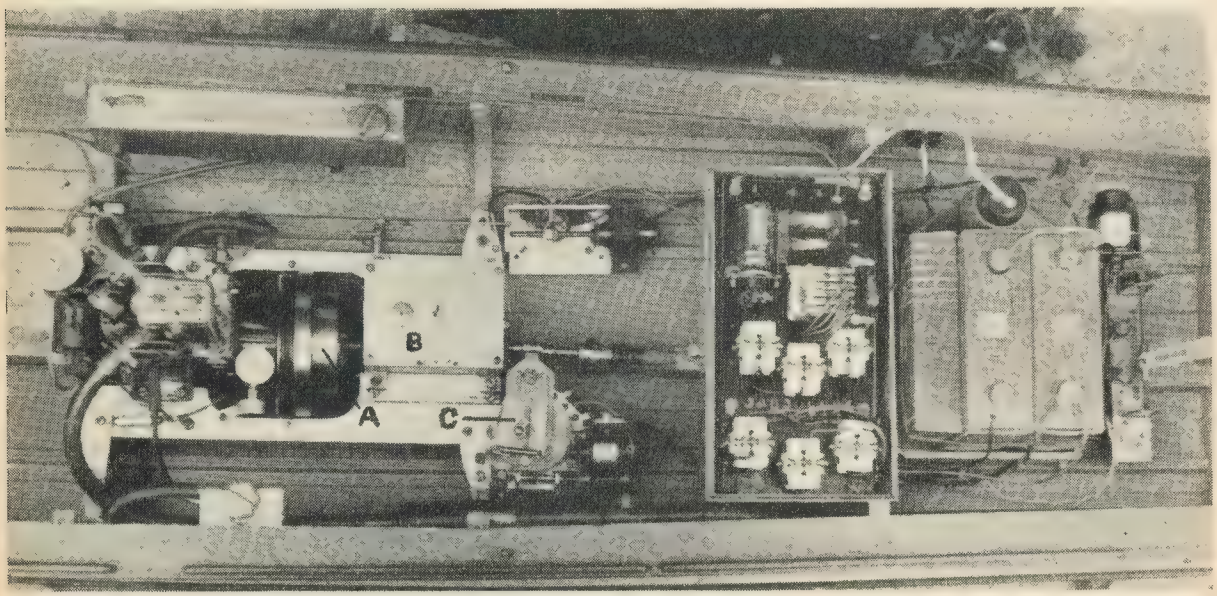
With his comment in mind, I decided that it was time that I got down to complete control, and throughout last winter, major alterations and additions were made to the equipment on board *Willardia*. On July 10th I was at the I.R.C.M.S. Regatta at Birmingham, and this year I was able to compete with the electrically-driven boats on very different terms. In fact, I scored full points for "control" and it was only through fouling a marker-buoy that I dropped to 3rd place in the results.

My radio consists of (*a*) a home-made transmitter, and (*b*) an adapted 3-reed receiver by E.D. This latter has had a home-made 6-reed unit fitted in place of the original 3-reed unit, and the chassis has been extended for the additional three relays. The whole receiver is housed in a box with sorbo packing and the connections are taken out *via* plugs, so that the whole unit can be easily taken out of the boat. The box protects the receiver against both moisture and oil and fumes, and is a most important item in keeping the many contact points clean and operative.

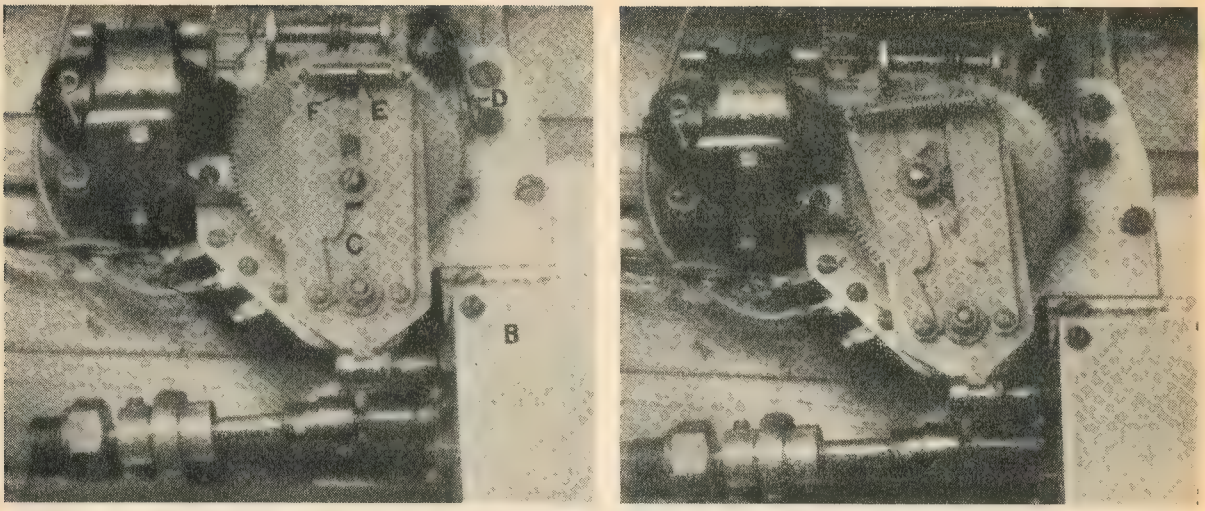
The mechanical control is in four sections: (*a*) proportional steering on conventional lines operated by two reeds (l. and r.); (*b*) variable throttle control worked by a similar unit to the steering, and operated by two reeds (fast and slow); (*c*) forward, reverse and neutral control operated in sequence by one reed; and (*d*) ancillary controls worked by rotary switch and operated in sequence by one reed.

The unit for (*c*) is laid out as shown in the photographs and comprises, first, a centrifugal clutch *A*, secondly a dog-clutch (crash) type gearbox *B*, and thirdly a motor-driven selector unit *C*. The centrifugal clutch allows the drive to be taken off the gearbox automatically when the engine speed drops below a pre-determined, level and the gears can then be engaged or disengaged easily. The selector unit is made to stop in four positions for forward, neutral, reverse, neutral, by the switch shown at *D*. This switch operates by making contact against a drum under the large gear. In this drum there are four slots set at 90 deg., into which the switch arm drops to break contact. When contact is made, the motor drives the drum round a quarter-turn, stopping when contact is broken by the switch arm dropping into the slot. The initial contact required to rotate the drum and move the switch to "on" position is supplied from the receiver, after which the drum completes its quarter-turn and stops automatically.

One further item is required on the selector unit; this is a means of spring-loading the coupling to the gearbox selector-rod. This was done by having a coupling arm in two halves, held together with a spring *E*, and located for neutral by the pin *F*. Now, as most often happens, if the dogs in the gearbox are not in line, the drum still rotates its quarter-turn, but only the spring-loaded arm moves. On increasing the engine revs., the clutch takes up the drive; the dogs turn until they are in line and the coupling arm pushes the dogs, *via* the selector-rod, into mesh. (This action is shown in



Plan view of installation, showing 10 c.c. petrol engine and control gear



Two views of the reversing gear control mechanism, showing method of operation

one of the photographs.)

The clutch shoes must drop in and out at near the normal tick-over speed of the engine, so that considerable experimenting will be required with the weight of the shoes/strength of spring ratio. Even so, I think that adjustable tensioning for the springs, as I have got, is very desirable.

The ratio of the gears as used in my gear selector unit is 600 to 1 with a "Mighty Midget" motor, and for effective working should not be any higher than this.

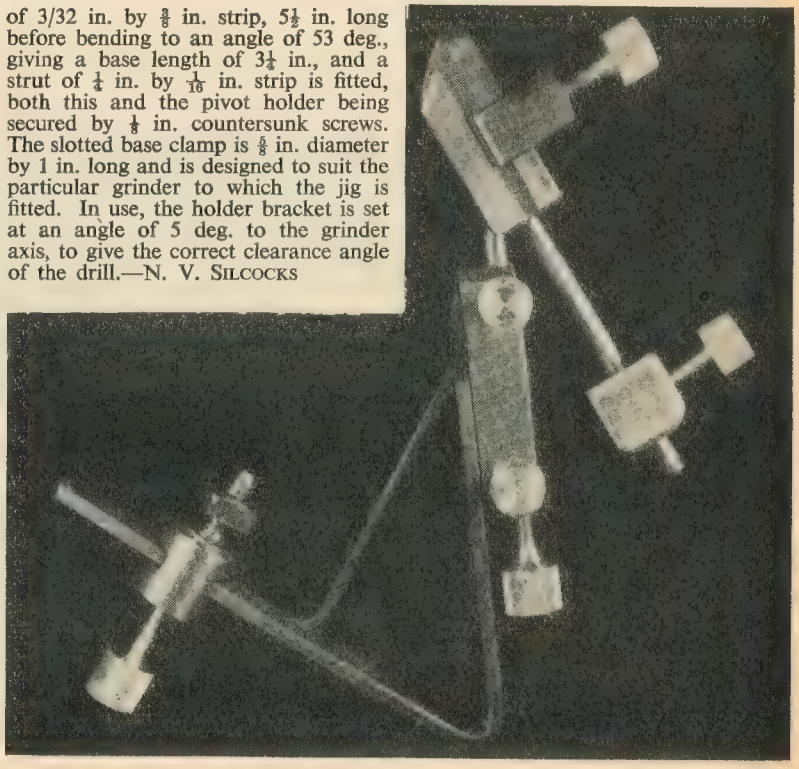
The ancillary controls mentioned can, of course, be used other than in sequence by the inclusion of a delay switch so that any contacts can be passed over; only the one at which one stops operating, after the delay switch "makes," will actuate the control.

A Simple Drill-Grinding Jig

IN submitting the photograph and brief description of this device, I am fully conscious of its imperfections, but I thought it might possibly be of interest to other readers who require a similar appliance which can be easily and quickly made.

The overall height of the device is 4½ in., and it is made of mild-steel throughout. The trough for the drill is ½ in. square section, 1¼ in. long, with a vee-groove 5/32 in. wide and grooves each side, 3/32 in. wide by 3/32 in. deep to take the clamp, which has an inside depth of ½ in. and is fitted with a knurled clamping-screw. An extension to the trough, in the form of a pin 2 in. long (including the inserted screwed end) carries a stop, ½ in. square, drilled a sliding fit on the pin, and clamped by a similar knurled screw. The pivot pin is screwed into the trough at an angle of 30 deg. to the axis of trough and stop pin.

A holder of ⅜ in. square section, 1½ in. long, drilled to a depth of ⅞ in. by 5/32 in., forms a socket for the pivot pin, the rest of its length being drilled and tapped ⅛ in. for the adjusting screw, which is 1½ in. long, including the knurled head and 1 in. screwed length. Two knurled locking-screws are fitted to the side of the holder to lock the pivot pin and adjusting-screw. This assembly is carried on a bracket made of 3/32 in. by ⅜ in. strip, 5½ in. long before bending to an angle of 53 deg., giving a base length of 3¼ in., and a strut of ¼ in. by 1/16 in. strip is fitted, both this and the pivot holder being secured by ⅛ in. countersunk screws. The slotted base clamp is ⅝ in. diameter by 1 in. long and is designed to suit the particular grinder to which the jig is fitted. In use, the holder bracket is set at an angle of 5 deg. to the grinder axis, to give the correct clearance angle of the drill.—N. V. SILCOCKS



QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:
(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Lathe Fittings

With reference to the mention of the "Walram" back gear for the 4-in. round bed Drummond lathe in a recent issue of THE MODEL ENGINEER, *will you please let me know how this back gear is fitted, and what it consists of? I would also like to know if you could tell me more about the screw-cutting guide which I saw illustrated a very long time ago in* THE MODEL ENGINEER.

L.C. (Croydon).

The "Walram" back gear is not at present available, as the production of the lathe itself ceased many years ago.

The principle on which this device, and other back-gear attachments for single-geared lathes, operates is by providing fittings to carry a shaft parallel with the mandrel, and gears which enable the speed to be reduced between the driving pulley and the mandrel itself. The pulley, of course, is made loose on the mandrel when the back gear is in action.

With reference to the screw-cutting indicator referred to, this appears to be nothing more than a fine adjustment device, which is used to control the traverse of the cross-slide, and therefore the depth of cut. It would appear difficult to apply this to modern types of small lathes, owing to the modified types of slides now in use; and the fact that these slides are now usually fitted with graduated indexes which enable the feed to be finely controlled, would seem to us to make it very largely unnecessary.

Axle for Trailer

I am building a car trailer, and wish to make my own axle from tubular steel with stubs fitted to the ends of the tubes. Please tell me a suitable material from which to make these stubs.

D.J.R. (Bromsgrove).

We presume that you will be using standard type ball- or roller-bearings in the hubs of the wheels, and, in that case, we are of the opinion that mild-steel stub axles would be satisfactory if properly made and fitted.

If, however, you require greater strength in the axles, an alloy-steel such as 3 per cent. or nickel chrome would be preferable. In the event of using plain bearings, case-hardened stub axles would be desirable. We do not, however, recommend plain bearings for this particular duty.

The "M.E." Drilling Machine

I am constructing an "M.E." Sensitive Drilling Machine from castings supplied by Messrs. W. H. Haselgrove, but I am in some difficulty as to how the headstock and table arm can be bored so as to ensure exact alignment. Can you please advise me as to the best way of doing this work on a 3½-in. lathe?

G.D.G.N. (Co. Armagh).

The simplest and most satisfactory way of boring the headstock and table arm for this machine on a 3½-in. lathe would be to bolt them horizontally on the cross-slide, packed up so as to bring the centres of the two bores exactly level with the lathe centres. After boring one hole, the cross-slide is traversed to bring the other centre into line.

We recommend that the boring should be done with a single-point cutter in a bar between centres, or supported at one end in the chuck and the other end on the lathe centre, and final sizing may be done with either a reamer or a floating cutter.

If the traverse of the cross-slide is insufficient to enable the two bores to be machined at one setting, care should be taken to preserve alignment when re-setting, by inserting a mandrel in the finished bore and taking careful measurement between the ends of this mandrel and a parallel mandrel set between the lathe centres. We may mention that exact alignment of the table centre with the drill spindle is not absolutely essential in this type of machine, so long as they are in parallel alignment, but it may be useful in certain cases to have these bores exactly in line, and this may be assured by using the above method for checking the distance between the two centres.

Stationary Boiler

I propose to construct a vertical test boiler of the type described in THE MODEL ENGINEER *recently by E. T. Westbury, and would appreciate your advice as to whether I can use the following items which are already available.*

(a) *Brass outer shell* $\frac{3}{16}$ *in. thick drawn tube 4 in. dia.*
(b) *Phosphor bronze inner shell with base integral.*
(c) *Phosphor bronze integral flue and angle top.*
(d) *Phosphor bronze for top and outer shell.*

(b), (c) *and* (d) *are* $\frac{1}{8}$ *in. thick all over, but can be machined thinner if necessary.*

I should also be obliged if you could advise me on the following points:—

(1) *Are the metals likely to produce stress by differential expansion on heating?*

(2) *Do you recommend turning these parts any thinner to increase quickness in steaming?*

(3) *Will silver-solder be satisfactory for all joints?*

(4) *Would it be advisable to screw the parts together as well as silver-soldering?*

H.D. (Leeds 6).

(a) The use of brass tube $\frac{3}{16}$-in thick for the shell of the boiler is practicable, though the section is unnecessarily heavy. As, however, it does not form part of the heating surface, it would have very little effect on the rapidity of steaming of the boiler.

(b) Phosphor bronze is not an ideal metal for the construction of a boiler or for other purposes where heat is applied, as there is a possibility that the phosphor tin which is one of its constituents may deteriorate and eventually cause porousness at high temperature.

(c) and (d) The same, of course, applies to the use of phosphor bronze for other internal parts.

(1) We do not think that any trouble is likely to occur by differential expansion of the metals, as this is very slight, and there is sufficient elasticity in the components to compensate for it.

(2) The only disadvantage of the extra thickness of metals is the increased weight of the boiler, and we do not think it will have much effect on rapidity of steaming.

(3) Silver-solder is quite satisfactory for making all joints, subject to the objections which we have already mentioned in respect of applying high temperature to phosphor bronze.

(4) We do not recommend a combination of screwed and silver-soldered joints, as it is often difficult to get satisfactory penetration of the brazing throughout the full length of the thread.

Next Week . . .

TURBO-GENERATORS
The construction of miniature steam turbines and alternators suitable for locomotive lighting and other purposes, by a South African contributor.

CONSTRUCTING A LATHE
How a reader's dream of his "Ideal Lathe" became a reality.

NOTABLE I.C. ENGINES
A description of a pioneer racing two-stroke, the 10 c.c. "Hornet," by P. G. F. Chinn.

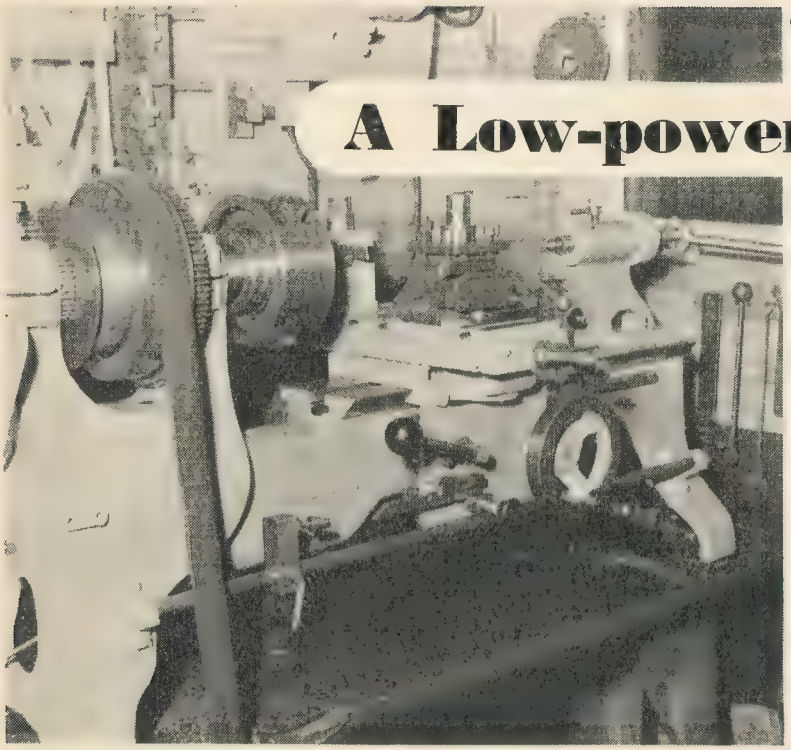
BUILDING A COMPRESSOR
More about machining the parts of the vee twin unit by "Duplex."

SELF-ACTING FEED MECHANISM
Details of gearing and fittings for obtaining a fine feed on a popular type of small lathe.

LOBBY CHAT
"L.B.S.C." discusses another example of really ancient small locomotive-making that has come to his notice, and shows how things have changed.

A Low-power Workshop

By S. H. Abigail



The 4 in. Relmac lathe. In the foreground is shown the engage and release mechanism of a split nut for internal leadscrew, operated through a Bowden cable

LIKE many others owned by members of our fraternity, the contents and scope of the writer's workshop have evolved by a gradual process of acquisition, extending over many years and commenced from quite humble beginnings. A much-prized collection of small hand tools formed the basis of operations, and a discarded kitchen table suffered long and valiantly under the efforts of an enthusiastic amateur. Ambition was not to be stifled, however, and today a complete outside workshop is available, which although small and compact, nevertheless is sufficiently well equipped to afford its owner many hours of pleasant relaxation. Probably its one drawback was, and still is, the lack of the electric supply mains as a source of power.

The lathe is a 4-in. Relmac, which is mounted on its own stand with treadle gear, and since the machine has thus been designed as a complete unit, it is quite efficient in its own sphere. It is a sturdy machine, and quite capable of all the work that is likely to embrace the average model engineer's interests. The lathe was pressed into service for many duties for some considerable time, including the drilling of all holes, except those undertaken by the hand brace.

Ultimately, however, the long coveted bench drill was acquired for a very small sum, the reasonable price being almost entirely due to the condition in which it was taken. The chuck was missing, the headstock broken, and the table bore very visible evidence of having been used with complete lack of regard by a previous owner. Indeed, it must be admitted that the purchase was subsequently viewed with some dismay, particularly as some means of driving it had still to be schemed out. A great amount of will-power was necessary to apply my energies to the task, but the machine was eventually coaxed back into working condition, even to the extent of giving a coat of paint to the castings, in order to make it presentable; and a visit was afterwards made to the local marine store in search of a suitable flywheel. Sufficient to record that sundry ball-races, chunks of flat and round iron, toil, tears and sweat, were all the forerunners of a contraption that worked by brute-force rather than scientific principles. It departed somewhat from orthodox design, perhaps, but it *did* produce results of a fashion, and it remained in a corner of the shop if only as a reminder to concoct something better.

The very necessary grinder for drills and lathe tools seemed out of the question as a separate foot driven appliance, as there was not the room to spare. Accordingly, the grinding wheel was perforce mounted on the tail end of the lathe mandrel, which is an arrangement that is totally inadequate for high speed.

A useful countershaft was rigged up over the lathe *via* a length of $\frac{3}{4}$-in. round mild-steel and a couple of ball-races set in wooden plummer blocks. The overhead was driven by a flat belt from the lathe mandrel, and a $\frac{1}{4}$-in. round belt from a small three-speed pulley was brought down to the cross-slide to provide the power to run a drilling and milling spindle.

Although the workshop is an outside one, it is within easy reach of the house, and it was a fairly simple job to take advantage of the domestic gas supply as a useful source of power. Accordingly, a pipe was tapped from the main and run through to the shop. This afforded a considerable improvement by providing better lighting and heating for the occasional evening job, and made possible the invaluable Bunsen burner and similar tools for workshop operations.

The foregoing, then, presents a general picture of the writer's workshop as it appeared some three or four years ago; and like many of our fellow model engineers, I must concede that enthusiasm and concentration to the task in hand helped to overcome many of the shortcomings. Work proceeded apace, with home-made appliances always on the list, together with a few models of sorts, an electric clock, a door chime, all carefully balanced by the production of some useful gadgets for the kitchen as a means of keeping the domestic authority in that frame of mind that will permit of other and more important work from time to time.

During one of the occasional visits made to a friend with whom the writer has much in common, we were on one particular Sunday morning discussing affairs in general, while taking our ease in his shop and absorbing a little more energy from the cup that cheers. The profound conviction of my host was that " to lay the dust " was the finest prelude to any form of activity, which is a philosophy that I find unassailable. The topic veered round to my own workshop and the conditions that I enjoyed (or regretted, according to my frame of mind), and we made a mental survey of the limitations under which I laboured, compared with my colleague, who was fortunate in having the mains power laid on. Possible remedies to one or two problems were sifted and probed, but little constructive progress was attained, until quite suddenly my friend brought all further conversation

to an abrupt halt by suggesting that, after all, he might be of some help.

The friend concerned is no modern King Midas. Had he the power of producing gold like that mythical potentate, then British Railways would have lost a valued employee long ago; but the prize that he excavated from an accumulation of gear under his bench, enhanced his reputation as a benefactor (in my estimation at any rate).

The article that was shown the light of day after what appeared to be a lengthy burial was, in fact, a portable electric generating set, made up of the well-known J.A.P. petrol engine of 98 c.c., coupled to a 288 watt dynamo; and typical of those which I believe did Trojan service in various spheres of activity during the war. Some further prospecting under the bench was indulged in and produced a companion in the shape of a 12-volt Nife battery. It appears that this outfit had been acquired with the object of putting it to some good use, but the idea had never materialised into anything more tangible; and he therefore offered me the lot at a very reasonable sum indeed. I accepted with alacrity, and the deal was completed on the spot, and tentative arrangements were made for shipping it home. I eventually became the possessor of a useful prime mover that promised to lighten my burden considerably during the pursuit of my hobby.

At the first opportunity the whole plant was given a check over, and apart, from a very audible indication of certain wear in the big-end, it appeared to be in good working condition. A couple of week-ends were expended on the not uninteresting task of servicing the engine itself, and this included the fitting of a new big-end liner; and the job certainly justified itself by the better and quieter running that has since been apparent. The dynamo commutator and brushes were cleaned, and wiring checked and passed O.K. The accumulators also were cleaned and generally overhauled, and supplied with a quantity of new electrolyte in order to make a fresh start and prepare these for the work ahead; in due course, the convenient Saturday morning arrived when everything was ready for a trial run. The generator was connected up to the batteries and an initial charge was pumped into them for a few hours; and it is gratifying to report that little trouble was experienced during this operation, and the behaviour of everything concerned promised well for future use. In view of the lack of a suitably muffled exhaust at this stage, it must be placed on record that the ensuing noise resulted in the raising of quite a few eyebrows from enquiring neighbours; and since they did not fall in with my suggestion that they should consider taking part of their summer holiday that week, they were afterwards comforted by the assurance on my part that they would find no cause for complaint when reorganisation was complete.

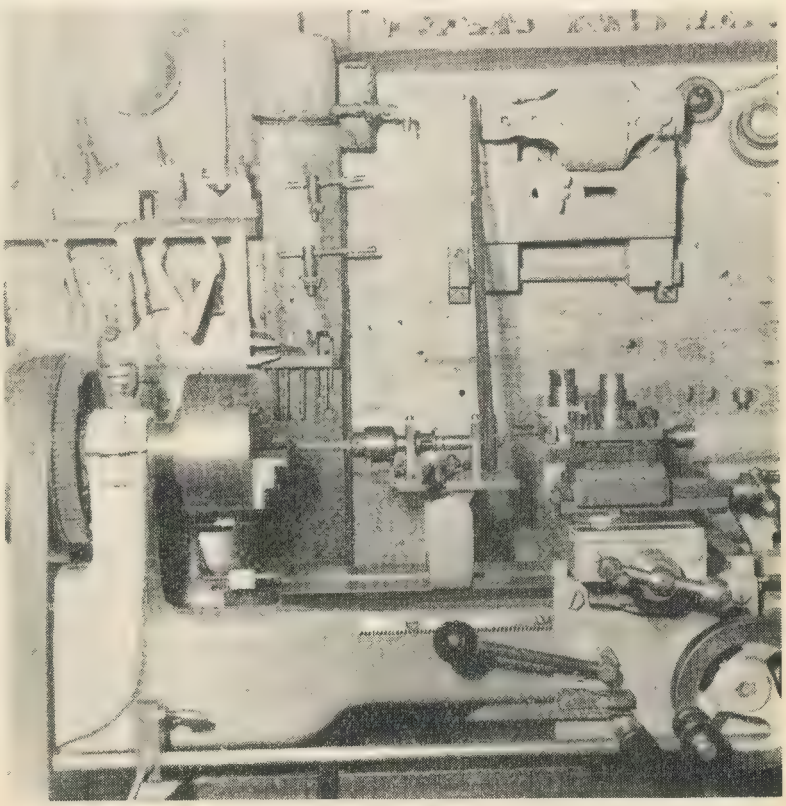
It might be appropriate here to reiterate that the incomparable Nife cells are in a class by themselves for power and robust service, and certainly justify the higher initial outlay. They are practically indestructible, and dead shorting produces no harmful effects; in fact, after being charged as above, a test was made on those very lines. A piece of thick copper wire was momentarily dropped across the terminals and both ends of the wire disappeared with a flash and a small report that indicated a capacity for work that was indeed welcome.

The generator, with its batteries, was then shelved for a period, while a survey of the interior of the workshop was conducted as a prior job to finding a suitable position for the newly acquired power house.

As mentioned at the beginning of this article, space is definitely at a premium, since the shop measures only about 8 ft. by 6 ft. by 7 ft. high. At present my equipment comprises the 4-in. Relmac lathe, a 6-in. hand shaper, drilling machine, woodworking bench, fitting bench and vices, a good set of woodworker's hand tools, ditto metal working including a surface-plate, sundry shelves, tool cabinets and finally an extremely useful stock of ferrous and non-ferrous material, round, flat, square and sheet, nearly all pigeon-holed for easy identification. When it is realised that all this is housed in the above den, it will be appreciated that this workshop is definitely not for those who suffer from claustrophobia. Its redeeming feature is that it is compact, and that it is necessary only to turn round in order to follow up from machining to fitting.

Considerable scheming was called for in order to find a resting place for the power plant, and resulted in a job being attended to that had been pending for a long time; that of clearing out a lot of useless junk that had long ceased to have any further value even for the scrap-box, as well as the re-arranging of boxes and cabinets. It would not be relevant to mention all the reorganisation that was indulged in, but eventually the job was accomplished, although not until a minor structural alteration to the workshop had been completed in order to straighten out a very awkward corner.

With the object of attaining a suitable outlet for the exhaust, the generator was located against the far wall viewed from the door end. (The word "far" should be taken with reserve.) The exhaust was led through this wall, and into a five gallon oil drum that had been buried outside for that purpose. The batteries were packed underneath the large woodwork bench, and protected from the accumulation of dust and dirt by a simple wooden cover. The rubber-covered leads from dynamo to batteries



Another view of the lathe with the drilling spindle set-up

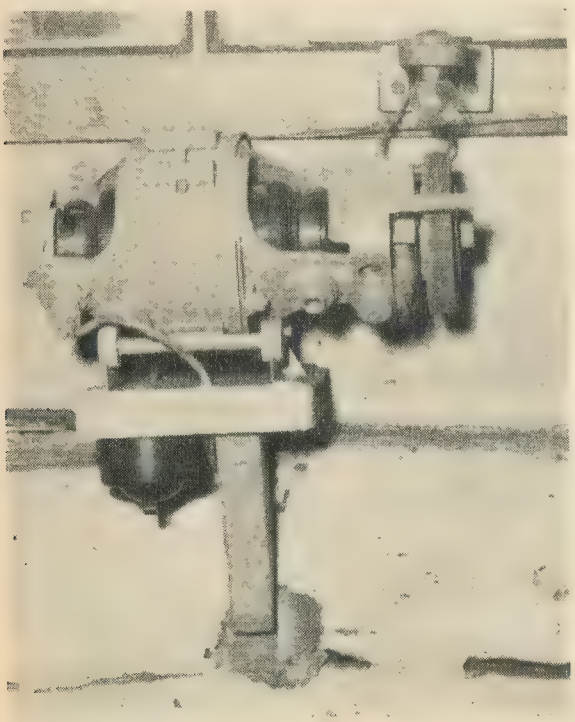
were then run round the back of the bench and left permanently in place. The entire effort was viewed with a certain measure of satisfaction, since the new arrival had been eased into the general layout with less trouble than had been expected; and the result appeared to be set-fair for making the generating plant earn its keep.

The almost obvious step in making the first call upon the batteries was for better lighting. A single gas burner had been the sole means of illumination up till now, and left a good deal to be desired, so no time was lost, therefore, in scrapping what was after all a make-shift affair, in favour of electric lighting. It may be mentioned that one lesson was learned during the change-over and that was the necessity of employing fairly stout wiring for these low-voltage circuits. Any small voltage drop from the conventional mains supply is, of course, hardly noticed from the original 230, but when the initial supply is only 12 volts, then it becomes a rather more serious matter, and every precaution must be taken to prevent any loss en route.

The first rig-up consisted of a couple of 12-volt 24-watt S.B.C. lamps, one at each end of the shop, and the first switch on with this arrangement was really surprising. The amount of light given by these small bulbs was more than adequate, especially with the battery fully charged; so much so, in fact, that a modification has been made whereby three lamps of 12 volt 12 watt each have now replaced the original two, giving better diffusion from three points, and at the same time cutting down the drain on the battery by one amp. This change-over from gas to electric lighting was most welcome, and it must be admitted that it formed a ready excuse for indulging in a little more evening work than hitherto. It might have been extended still further, but for the poor view taken of this practice by certain powers that be.

Some few weeks afterwards, and incidentally during a spell of much warmer weather, the writer was engaged one day on a job necessitating the drilling of several holes in mild-steel. It will be remembered that the only appliance for this operation (other than the lathe) was the ancient drilling machine mentioned beforehand, and the physical effort needed to coax those not very sharp drills through the material nearly rendered me unconscious. While I gamely battled through, I made a mental vow that it would be the last under such conditions, and later that evening an arrangement was sketched out for motorising the drilling machine.

It was during the preliminary work on the job that a critical eye was cast over the condition and general lack of efficiency of the machine itself, and in view of the drilling machine being second in importance only to the lathe for workshop operations, it was decided that something better was called for in the general scheme of things, and in order to maintain the higher standard that was being aimed at. Accordingly, the family vaults were deprived of certain of their gold stocks in order to purchase a set of castings of the well-known Cowell drilling machine; and my energies were then directed over the next week or two to the production of this excellent tool of $\frac{3}{8}$-in. capacity. It was interesting work, and in due course the completed machine lent a much more professional air to the surroundings; and it was hoped that a little more precision and efficiency could be brought to bear upon the job in hand when the drill could be put to its legitimate use.



The first ex-R.A.F. generator conversion, dismantled and rebuilt as a bench grinder. The lamp is connected across the 6 V output terminals

Having set the machine up on its own small bench, there came the problem of a motor to drive it; and it must be admitted that a fair number of suggestions and rejections were indulged in to find a suitable answer. A $\frac{1}{4}$ horse-power is required for the machine and several avenues were explored and other expert advice solicited in order to find the best medium. Most suggestions that I received were unanimous in the conviction that the only motor of comparative power at 12 volts would be the car starter type. Although these starters are robust and give the output easily enough, I have it on good authority that they are somewhat low in efficiency, although this is a characteristic that can be ignored to a certain extent when the motor is used in its normal province. Since, also, they must necessarily swallow up the battery volts at an alarming rate, the arrangement was approached with some trepidation. However, since there was no apparent suitable alternative, contact was made with a garage proprietor of my acquaintance, and a Lucas motor changed hands at a figure that satisfied both new and previous owner.

It appeared neither necessary nor desirable to make any major alteration to the motor in order to fit it for its new field of service; in fact, the only amendment was to remove the spring and pinion from the end of the shaft, and to replace them with a 2 in. aluminium "V" pulley keyed in position. A couple of brackets were attached, conveniently by the two long bolts that pass through the end plates of the motor, and the brackets then firmly screwed to a stout baseboard. Finally, the baseboard was hinged vertically between two legs of the large woodwork bench; and thus a useful amount of belt tensioning was possible between the motor and the drilling machine adjacent to it. A $\frac{3}{8}$ in. round belt formed the connection, which fortunately had been kept fairly long, and in due course it was possible to try out the new system, which had been connected up with thick wiring and substantial foot switch to carry the heavy current flowing. Incidentally, this was the first try-out of the new Cowell machine since it had been finished, and the opportunity was taken to observe the behaviour. It is, perhaps, sufficient to record that everything came up to expectations, and the motor handled all the drills within the capacity of the chuck with only a slight drag on the largest of these.

As a point of interest, an ammeter reading up to 30 amps was connected in series with the motor and the latter then switched on; and the way the needle swung over to full load and remained hard on the stop made me glance somewhat apprehensively at the battery. This, I might add, was not with the expectation of any visible signs of distress, but rather as an instinctive gesture on my part. However, after the first experimenting, during which a score of quite unnecessary holes were

drilled through a chunk of inoffensive mild-steel, the novelty gave place to intelligent use, and I found that the short runs required were well within the capacity of the batteries. These, by the way, were made up of 75-amp cells. It is surprising the number of holes that can be drilled in a couple of minutes only, and the improvement over the original treadle contraption can be imagined.

It will be remembered that the only grinding appliance on hand was the not-very-efficient attachment rigged up at the tail end of the lathe mandrel. Since, therefore, power was now on hand, there appeared no excuse for not designing a more satisfactory means for the necessary sharpening operations on drills and lathe tools.

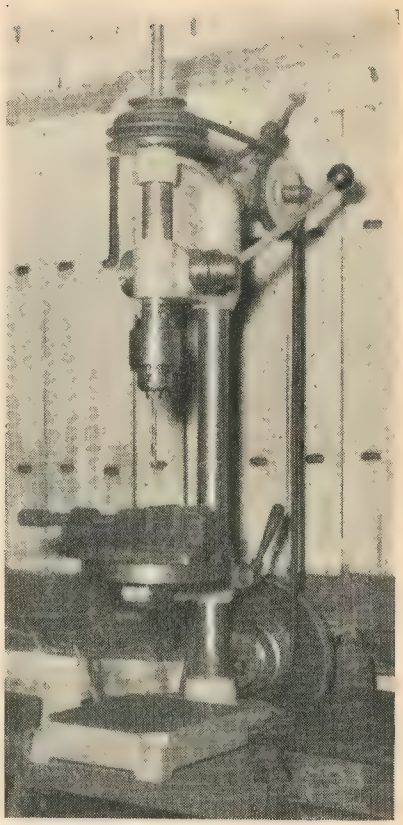
The process of earning my daily bread, involves a fair amount of travelling in and around London, and during the extent of these peregrinations, a weather eye is always kept open for likely second-hand and Government surplus stores, where, very often, useful and interesting bits and pieces can be acquired and pressed into service, although it may not be in the legitimate sphere of the articles concerned. Thus it was that, one day, one of these happy hunting grounds was displaying a large quantity of ex Government small motor generators. Two types were offered, with either 12-volt or 24-volt input, and each having 6-volt and 250-volt output, together with related values of output amps. Doubtless many readers will be quite familiar with them.

The opportunity was taken to inspect one of these instruments and upon a question being put to the vendor, the information was forthcoming that the 12-volt type absorbed about 5 amps of current. This indicated (by a little mental calculation) something in the region of one-twelfth horsepower, in theory at any rate, and, therefore, showed distinct possibilities. In view of their cheap price (something under 5s.) I availed myself of one of the 12-volt pattern; and on the fitting bench later that day it was first given a run up for ten minutes to clean the brushes, commutator and end ball-races, and then the instrument was partly dissected. These generators run at high speed, and, on the face of it, they appeared to lend themselves to an adaption on the lines of what I had in mind. They are prone to a fair amount of noise and vibration when running, but this was of secondary importance, and, in any case, the latter can be damped down by the judicious use of rubber packing between the motor and any baseboard fixing. The instrument base, which contains a small transformer and sundry condensers, was unbolted and discarded and the motor itself together with its fixing brackets was screwed *in situ* to a wooden base. Considerable thought was lavished on the conversion at this stage, in order to arrange a suitable extension spindle, since the first inspection showed that the original spindle finished abruptly at the end ball-race cap. However, a more thorough investigation of the parts concerned caused me to offer up a mental prayer of thanks to the unknown designer; since upon removing the cap I found my problem solved on the spot by the sight of a 2-B.A. hole drilled and tapped in that end of the spindle. The inclusion of this hole in the design seemed somewhat obscure, since it appeared to serve no useful purpose as far as could be ascertained; but, be that as it may, half my own troubles were over.

It was necessary only to turn down a piece of $\frac{3}{8}$ in. round mild-steel to a 2 B.A. size one end and threaded $\frac{3}{8}$ in. B.S.F. complete with nut and washer the other. The small end was screwed home tightly to the motor spindle, a 3 in. medium grit wheel slipped on, and clamped home by the nut and extra washers of blotting paper. A simple tool rest was made, and a sheet-metal guard to protect the bearings; and as a further refinement, two leads were taken from the 6-volt output terminals and connected to a suitable bulb fixed in a holder and located just above the wheel. The finished grinder found a resting place on the wall, to one side of the fitting bench, and upon switching on for the first try-out, it became clear that it would no longer be necessary to retain the unsatisfactory arrangement that had done duty up till then. I was very pleased with the new appliance, coping, as it does, with all the drills and lathe tools that I use, while the light directed from over the wheel is inestimable on fine work. The light, of course, draws its current from the generator when running, and no additional burden is placed upon the main battery.

So gratifying was the performance of the new acquisition, that no time was lost in procuring another of these generators; and tentative arrangements were made to dismantle the rather cumbersome overhead gear then in use, for a much neater and more convenient system built round the generator as a driving unit. The latter was stripped as before, but this time fitted with a 2 in. brass pulley instead of an extension, and the unit then clamped to a hinged baseboard similar to that on the drilling machine. A position was found for it on the wall behind the lathe, where it was screwed in place; and, as before, the swing of the hinged board accommodates various belt lengths when the motor is connected to a small drilling spindle mounted on the lathe *via* a $\frac{1}{8}$ in. round belt.

Once again I am pleased to report that the motor rose to the occasion admirably, and no trouble is experienced with practically all the drills that can be accommodated in the $\frac{1}{4}$ in. chuck. It was, of course, intended for small and fine work only, and, as such, the unit came through with flying colours. Since clock and instrument making are



The Courell drilling machine built from castings

listed among the writer's interests, a design has been sketched out for a miniature lathe of about $1\frac{1}{8}$ in. centres, to be bolted when required to the cross-slide of the large machine, similar to the drilling spindle. The power developed by the generator described above leads me to believe that sufficient should be available to drive a lathe of small proportions, and the latter would undoubtedly prove a worthy addition to the workshop equipment.

As a point of interest, it might be mentioned that the ammeter was once again prevailed upon to answer the question as to how much current was being absorbed by the little motor. On switching on, the needle of the meter swung over to 25 amps momentarily, but dropped almost as quickly and maintained a steady 5 throughout the running time.

Since my workshop faces due south, and is not otherwise screened by any buildings, etc., it will be understood that the internal temperature during the summer months sometimes reaches uncomfortable proportions; and on more than one occasion all activity has had to be suspended for this reason.

Among other useful paraphernalia collected from the surplus merchants from time to time were a couple of B.T.H. d.c. motors of 12-volt one-

twentieth horse, both purchased with the prevalent idea that they might at some time or other be put into service. One of these was taken in hand, and a small brass collar turned up to fit the spindle and fixed by a grub-screw on the flat. Four fan blades were cut from sheet zinc and a stiffening piece of brass rod was soldered down the centre of each, and the ends of the rods then fixed equidistantly round the collar by a drilled hole and a touch of solder. This new luxury fitting was then mounted on a shelf just behind the operator when at the lathe, and the extra one amp drain on the battery is considered a small price to pay for the non-stop production that can now be indulged in during the hot weather, since the cooling breeze brings added bliss to the owner-occupier.

The latest (and probably the last) call that has been made on the long-suffering accumulators has been in the field of the domestic radio. Since the mains are not available, my wife has enjoyed "music while she works" through the medium of a battery-operated set. With the object of reducing the running costs (for which, incidentally, she is responsible), three leads were run from my shop to the house and tapped at 0-2-6 volts respectively. These leads now supply the 2 volts for the filament current, and 6 volts for the input terminals of a vibrator power pack which has been installed in place of the original h.t. battery. The receiver is still battery-operated, therefore, but the purr of satisfaction from certain feminine sources after this new innovation gave rise to the belief that my position as head of the house has lately been redeemed somewhat.

Let us return to my workshop for a final chat, and possibly to forestall a question that several readers may be pondering over. Yes, I know, the main machine tool has not been embraced in this motorisation business, and the lathe is still treadle operated. Long and careful has been the meditation on this point; and it has been finally decided that, mainly for reasons of economy, this essential tool shall remain as it is. Although the drilling machine motor makes vast inroads into the capacity of the battery, the fact is that, as was mentioned earlier, the spells of running are really quite short, and between calls the battery is able to recover itself without undue distress. The lathe, however, is a different matter, in view of its extended use, and it was with due regard for the otherwise excellent service of the cells that it was decided not to put a further drain upon it. In any case, the lathe, being a properly designed treadle appliance on its own stand, was far in advance of the Heath Robinson monstrosity that rejoiced in the name of a drilling machine; and, with due regard to bearing lubrication and essentially sharp tools, this treadle lathe has served its owner well and faithfully.

At one time the idea was toyed with of rigging up another countershaft and using the petrol-electric generator as a works power unit. The idea never got beyond the drawing-board stage, however, because there just wasn't the room for the alteration, which, in any case, would have meant the dismantling of the fitting bench.

I should like to conclude this article with a brief reference to the running costs of my little plant, possibly as a guide to those who might have contemplated a similar system. This guide can only be general, for obviously it would be of little value to give just the data that applies in my case, since costs, of course, are related to the extent of use, which in turn is dictated by the amount of spare time that we can devote to our hobby. It must be admitted that during the wintertime only a very small amount of work is indulged in after dark; and week-ends form the main periods of activity with perhaps an occasional evening job that cannot be shelved. Under these conditions, the battery is charged once a fortnight. This charge is accomplished with one tank full of petrol (a little over a quart) which runs the plant for about three hours with an output of 24 volts 20 amps. Lubricating oil must not be forgotten, of course, but only a cupful is required, and a quart tin will last many weeks. During the summer months, when the lighting is hardly ever used, the battery has maintained a useful voltage for as long as four weeks; and it has been calculated that over a period of a year the total running costs have been in the region of 1s. 6d. per week or possibly less. A further small sum must be earmarked for the replenishing of the electrolyte of the cells in due course, but the life of this is usually reckoned in years. The largest item of expenditure is for petrol, of course; and any fluctuation in the price must be allowed for.

Let it not be imagined that the improved conditions that I now enjoy in my workshop are in any way to be preferred to the services of the normal main supply; to have unlimited power on hand is, of course, the ideal, and fortunate are those who are so equipped. I am certain, however, that I am in the company of many whose workshop production has been accomplished through the medium of physical energy when it comes to driving power; and I contend, therefore, that the system outlined in the foregoing notes has much to commend it. This article has been submitted in the hope that it may prompt a train of thought among those similarly placed with the writer.

I am very much indebted to Mr. Clarke, an enthusiastic member of the local Association of Camera Clubs, who was responsible for the photographs illustrating the text.

For the BOOKSHELF

Practical Lessons in Metal Turning and Screwcutting, by Percival Marshall. (London: Percival Marshall & Co. Ltd.) 178 pages, 7¼ in. × 5 in., 220 illustrations in line and half-tone. Price 6s.

This is an entirely new edition, revised and enlarged, of a popular handbook by the late Editor and founder of THE MODEL ENGINEER. It is still fully up-to-date, as the general principles of lathe operation have not changed, and the instructions, intended as a guide to the inexperienced worker, are as sound as ever. In fact, the book has practically attained the status of a classic work, having been copied or imitated in several languages, and its emphasis on basic methods, rather than reliance on elaborate equipment, makes it specially useful to the amateur with a small, simply-equipped lathe. The practice and principles of generating threads on the lathe are simply explained, with arithmetical calculations for gear trains, and screwcutting tables for gear trains for trains with various pitches of lead-screws.

The Boys' Book of Locomotives, by T. E. North (London: Blackie & Son Ltd.) 32 pages 5 in. by 7 in. Illustrations in colour. Price 3s. 6d. net.

This is a pocket-size book that can scarcely fail to delight any railway-minded boy who is fascinated by steam locomotives. At the top of each page is a picture in colour of some well-known type of locomotive, and below it are brief particulars and a list of names or numbers. More than thirty British and foreign locomotives are included, each depicted in action, and, on the whole, the result is very pleasing.

Those Were the Trains, by H. Gordon Tidey. (London: Ian Allan Ltd.). 64 pages, 5 in. × 9 in. Numerous illustrations. Price 7s. 6d. net.

Collectors of photographs of railway trains will welcome this book, if only because it consists of a selection of about 120 re-productions of the work of one of our leading experts at this sort of thing. Mr. Tidey has been photographing trains since the late 1890's, and in this particular field his name is revered all over the world.

The period covered by this book is approximately the first 25 years of the present century. Many of the pre-grouping railways are represented at a time when they were at their best In a few of the captions, memory seems to have failed with regard to the localities depicted as well as with the descriptions of some of the engines and trains; but in practically every case, the quality of reproduction is very satisfactory, helped largely by the stout art paper on which the whole book is printed. About three pages are devoted to a most interesting article in which Mr. Tidey gives some of his recollections; the rest of the book consists solely of photographs and captions.

READERS' LETTERS

Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

CHEQUER-PLATES

DEAR SIR,—With reference to the problem of producing scale chequered plates for platforms such as on steel landings, gun bases or other places where a foothold is needed, the following method can be used in a number of ways as well as for plates such as badges, nameplates, etc., where a shallow recess is needed.

The metal is well cleaned, and the part which is required to be raised coated with an acid resist, including the back and edges. Only a light etching will be needed for floor plates in most models, but I have etched to a depth of 1/32 in. with no trouble on brass (for car badges) and to a useful depth on other metals. The correct acid and resist will be known by most people interested. On most footplates on the building side of industry, bolt holes, slots for lifting the plates, and the edges, have a raised portion the same size as the area. The slightly rough surface left by the acid is a very good substitute when given a coat of brownish paint to imitate the usual slightly rusty finish of such plates.

Yours faithfully,

York. E. RUDD.

LOADS FOR 5-in. GAUGE

DEAR SIR,—It was with some surprise I read in "L.B.S.C.'s" article a few weeks ago that some of his correspondents seemed to think that one adult is a reasonable load for a 5-in. gauge express locomotive. One could have understood such an assertion being made in the early nineteen-twenties, but in these enlightened days, when there are numerous efficient miniature engines, and club tracks all over the country on which to run them, such statements are utter rubbish, and it makes one wonder if they are made by "armchair antagonists" rather than active locomotive enthusiasts.

I am not writing without some experience in this particular field, as I have a 5-in. gauge 0-4-0 tank engine *Tailwagger*, which was illustrated by "L.B.S.C." some years ago. During the last run she had on the Wolverhampton club track, which has a 100-ft. bank of 1 in 100, she was taking loads of two adults and eleven children on three bogie trolleys without any fuss at all. I do not consider this in any way exceptional but merely a normal load for the type and size of locomotive, and no doubt many of your readers could quote equivalent or better performances. I may mention that none of our club members' engines, either 3½-in. or 5-in. gauge, has any trouble in climbing this gradient with good loads.

I would like to make it clear that I am not doubting the capabilities of either of the locomotives which ran at "Beech Hurst" as I have never seen them in steam, but am quoting the above in support of "L.B.S.C.'s" contention that, on that occasion, they were hauling featherweight loads.

Mr. Austen-Walton's latest water gauge is interesting; apart from the glands it is very similar to "L.B.S.C.'s" original "George Washington" type which he described just after the advent of his notes and also illustrated in the original *Live Steam Book*. In my opinion it would be difficult to clear the waterways without removing the fittings from the boiler; a disadvantage which is overcome in his later design, the "Stroudley-Washington," also detailed in that book and specified by him for all his engines since that time.

Yours faithfully,

Woodsetton. C. J. F. COX.

A MODEL STONE-SAWING MACHINE

DEAR SIR,—A few weeks ago I was walking along a road near the Swiss village of Wilderswil, when I caught sight of something moving in a garden. On investigation, the something proved to be a remarkably accurate model of a stone-sawing machine, almost like those that are used up here in the West Riding, except that it was driven by an overshot water wheel about 10 in. diameter.

The saw frame had a ratchet feed device for lowering the saw, but the worm gearing was missing so it was not in working order. It also had a dipper wheel for returning the grit ejected by the saw into the cut, and a spill valve for stopping the water wheel was fitted as in full size practice.

Yours faithfully,

Shipley. FRANK D. WOODALL.

MODEL BOILER MAKING METHODS

DEAR SIR,—I am pleased to note, from the letter of Mr. A. C. Brodie in THE MODEL ENGINEER of October 7th, that the article on the above was of interest to him. Therefore, I feel sure he will not mind when I say that he might have read it a little more carefully. I did not wish when writing the article to include any formula, as these, I think, often tend to scare off would-be builders. However, that which he quotes, namely, "25,000 × plate thickness × 2 over barrel diameter" is in effect the same as quoted in the article, when instancing a 10 in. diameter barrel ¼ in. thick, working at 100 lb. p.s.i. Moreover, if he reads it again he will see that I stated that for a ¼-in. wall thickness this would give a factor of safety of 12, and we could work at a higher pressure or use a thinner plate of $\frac{3}{16}$ in. or 5/32 in.

My idea in quoting a 10 in. barrel with ¼ in. thick walls working at 100 lb. pressure was that it should be an easy example for anyone not conversant with boiler design to follow. This was my fond hope which, it seems in Mr. Brodie's case at least, was an impression I failed to convey.

Yours faithfully,

"GASBAG."

Mr. H. Darby's "Foster" traction-engine at an agricultural show

A BRILLIANT FOSTER

DEAR SIR,—I send a photograph supplied to me by Mr. H. Darby, of Sutton in the Isle, of his three-speed Foster engine shown by him at a local agricultural show. It was bought from the Right Hon. Lord Gretton and "prettied up" with showmen's fittings, etc., by Mr. Darby, who is an ardent steam fan.

He has kindly offered the loan of a portable engine to the model engineering enthusiasts at March, and invited us over to Sutton for an afternoon. He proposes to put his Foster in steam for us, and possibly the Fowler which he entered at the Royal Norfolk show at Norwich.

Yours faithfully,
March, Cambs. L. J. CATEY.

BORING ATTACHMENTS

DEAR SIR,—The description of Mr. Dunn's boring attachment in your issue of October 7th reminded me of a large boring mill on which I worked during my apprenticeship days.

This was an old machine even then, and the only feed provided for the facing slide was a five or six tooth star wheel on the end of the feedscrew. This gave a very coarse feed even for the very large work done on the machine, consequently the star wheel was usually removed, and it was standard practice to apply a spanner to the squared end of the feedscrew each time it came round, and give it a bit of a tug as it passed. One became quite skilful at this dangerous practice, which was not quite as hazardous as it sounds, because the head was not revolving very fast when facing a flange several feet in diameter.

At a later date, I fixed the top-slide of my 3½-in. Drummond to the faceplate so as to convert it into a boring mill as Mr. Dunn did, and found it extremely useful on occasion.

As a star feed was far too coarse, I fitted a knurled knob to the end of the feedscrew, and applied the feed by hand. I found it both dangerous and very tiring, and I don't recommend the method to those who value their fingers.

There is a definite limit to the number of teeth that can be used safely on a star wheel, and six is generally considered to be about the maximum, otherwise there is a risk of the striker contacting the extreme top of a tooth and causing a smash up.

This is especially likely to happen if the speed is high, and the slide not properly tightened up, as Mr. Dunn rightly points out.

Two ways suggest themselves for getting a finer feed, assuming that a star wheel of more than six teeth is not practical politics:—

(1) Remove the existing feedscrew and nut and substitute one with a fine thread, say 32 t.p.i. A V-thread would do.

(2) Mount a bracket on the end of the slide to carry a couple of gear wheels, so as to get a gear reduction of about 4 to 1 between the star and the screw.

The provision of a simple method of feeding the slide while in motion is the main difficulty in using the lathe as a boring mill, and, if any readers have found a good solution to the problem, I think it would be of general interest.

Yours faithfully,
Berkhamsted. JOHN LATTA.

EXHIBITION LOCOMOTIVE MODELS

DEAR SIR,—Mr. Maskelyne's article "Locomotives at the 'M.E.' Exhibition" raises some interesting points on which I should like to comment. I must point out first, however, that I have a wholesome respect for his views on locomotive matters, and that these comments are not criticisms.

The first concerns the fact that Mr. Bridgett made his "Nelson" without having seen one. Such a circumstance need not deter anyone who has a particular prototype in mind. I cannot say I have never seen a "Princess Royal," but I *can* honestly say I have never *examined* one, and that I never saw one during the whole time I was building mine. We have Mr. Maskelyne's word for it that it is not too far off the mark.

If anyone is interested, my sources of information were: (*a*) H. P. Jackson's drawings which, although they would not win any prizes for draughtsmanship contain a vast amount of valuable information and no errors worthy of the name.

(*b*) A picture postcard of *Princess Helena Victoria* (the loco, not the lady).

(*c*) A picture of *The Princess Royal* in a popular book on locomotives.

(*d*) A coloured reproduction of an artist's impression of doubtful accuracy of *The Princess Royal.*

(*e*) An active imagination, and an eye for a good job.

When I started my "Princess," I knew next to nothing about locos—I don't know much now! I chose this one because I saw a picture and liked the look of it; so "don't be fright."

My next point concerns paint. After saying a lot of very kind things about my loco (I must get a larger hat!), Mr. Maskelyne finishes with a crack about "rather hideous purple-brown." It is a jolly good purple-brown! The point where we fall off is that it is *not* the proper L.M.S. colour. I had good reasons for using this diabolical paint, which, by the way, is a heat-resisting stoving paint, but they need not bother us at the moment. The point at issue is the difficulty of finding the exact colour of liveries no longer in use. The experts [*sic*] were unanimous that mine was wrong, but when I asked what it should be like they were all anxious to talk of other things. It is time somebody did something about this. There have been some half-hearted attempts, but as far as I know there is no entirely reliable source of information.

I warn "J.N.M." that one day I shall call his bluff. When in due course the "Princess" is due for a repaint he shall select the colour! I must confess that I don't like the present colour myself.

May I conclude with a warning to would-be future contestants? *Do not* enter your model in a competition unless you *know* you can get it finished in time. I all but made myself ill trying to finish mine. I think, however, that as things turned out it was worth it.

Yours faithfully,
London, S.E.9. A. L. HUTTON.

WITH THE CLUBS

Harrow & Wembley S.M.E.

Our exhibition will be held on Saturday, November 20th, at Wesley Hall, Park Lane, Wembley. It is opposite the Majestic Cinema, High Street.

The Sheffield & District Society of Model & Experimental Engineers

The society's 19th annual general meeting will take place on November 4th, at 7.30 p.m. It is requested that all members attend.

Nov. 18th.—Film night.

December 2nd.—"Bits and Pieces."

Meeting Room—278, Western Bank, Sheffield.

Hon. Secretary: W. A. MILNES, 20 Castlewood Road, Fulwood, Sheffield, 10.

Birmingham Society of Model Engineers

After a very full and successful summer programme, which included a visit to the Vale of Rheidol Railway, inter-club trials v. Romford at home and away, etc., etc., the following programme has been arranged for the next two months.

Nov. 17th, at the Crown, Broad Street. Film show.

Nov. 24th. Visit to Aston locomotive sheds.

December 1st at the Crown, Broad Street. Talks and discussion on our successes in the locomotive trials.

December 15th, at the Crown, Broad Street. Open night.

December 29th, at the White Horse, Congreve Street. Film show.

Lone hands and fellow enthusiasts are invited to join us and participate in our social programme which covers all the year round with lectures, etc., during the winter and mostly outdoor fixtures during the summer. Come and bring your problems along: someone will surely be able to help you. We are founded on mutual help and interest.

Hon. Secretary: J. E. GUY, 21, Kenwood Road, Bordesley Green East, Birmingham, 9.

The Junior Institution of Engineers

Friday, November 5th, at 7.0 p.m.—Pepys House, 14, Rochester Row, S.W.1. Film evening. Agriculture films, to be introduced by Mr. E. A. Applebee (member).

Sheffield and District Section — Monday November 8th, at 7.30 p.m., at Livesey Clegg House (opposite Union Street Cinema), Sheffield. President's Address: "The Nation's Water Supply," by J. Noel Wood, M.C., M.I.C.E., M.I.W.E.

Friday, November 12th, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Ordinary meeting. Paper: "Corrosion," by W. F. Gerrard, F.R.I.C.

Friday, November 19th, at 7.0 p.m. Pepys House, 14, Rochester Row, S.W.1. Chairman's Address: "Engineering Plant in Buildings," by S. G. Clark (member).

Friday, November 26th, at 7.0 p.m. Annual General Meeting.

Ashford & East Kent M.E.S.

At the annual competition for the "Dr. Roberts Prize," the following were adjudged the winners.

First: J. Hanson ("Britannia"), Dr. Roberts Prize.

Second: C. B. Butcher (free-lance tank loco), F. Norman Prize.

Third: O. Cheal ("Hielan' Lassie" and "Britannia" frames), Club Prize.

Highly Commended: C. Glover (liner hull).

The winter programme of films began on Wednesday, October 6th, and will continue on the first Wednesday in every month. Members are asked to make a special effort to attend.

Among other forthcoming attractions a visit to the Ashford railway works has been promised.

Hon. Secretary: C. B. BUTCHER, 63, Hythe Road, Ashford, Kent.

Salisbury & District M.E.S.

Owing to the growing membership of the Society, a separate meeting night has been allotted to each section, and in future the General Engineering Section will meet at the workshop in the Leg of Mutton Field every Monday evening; aeromodellers on Tuesdays; the Model Railway section on Wednesdays and Model Car Section on Fridays, with Thursday evening spare for general meetings, lectures, etc.

A number of small-gauge railway modellers have been enrolled recently and the section proposes to construct a club layout.

A rail track is being built by the Car Section and it is hoped to lay down a circular track for cable racing next year.

Hon Secretary: R. A. READ, 90, Woodside Road, Salisbury.

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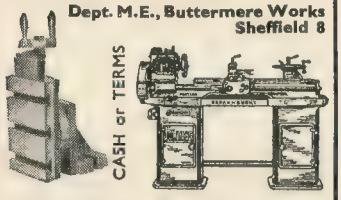

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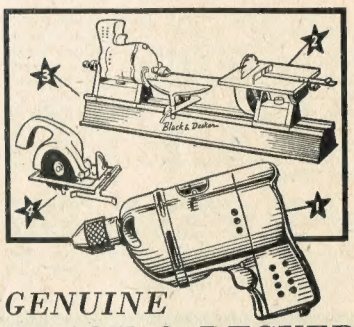

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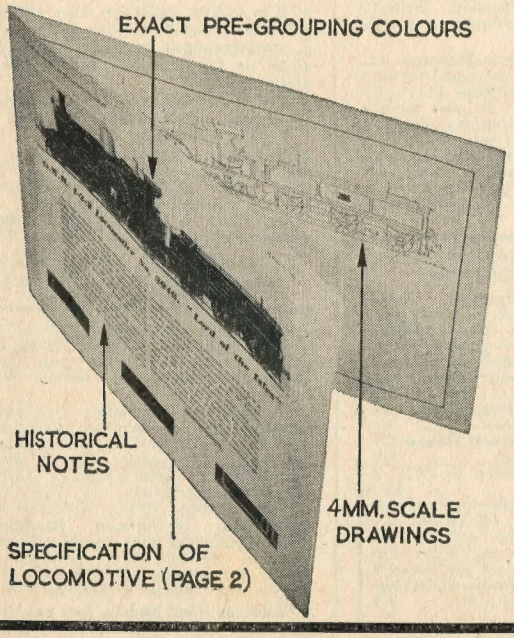

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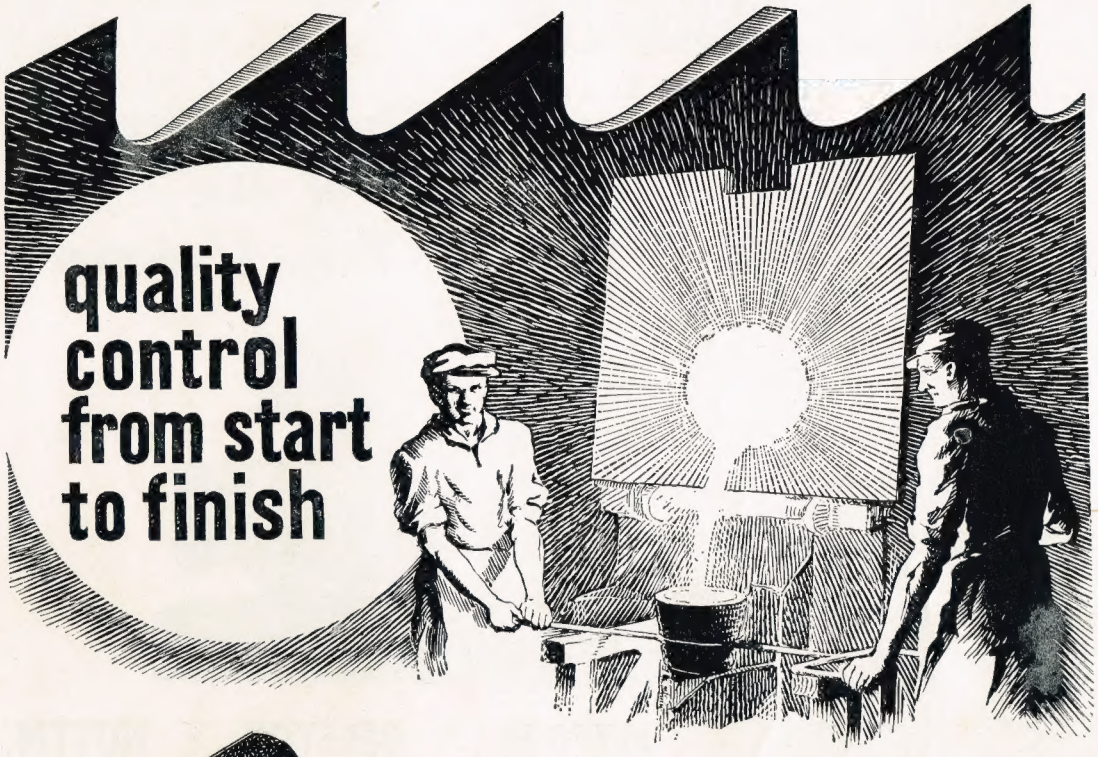

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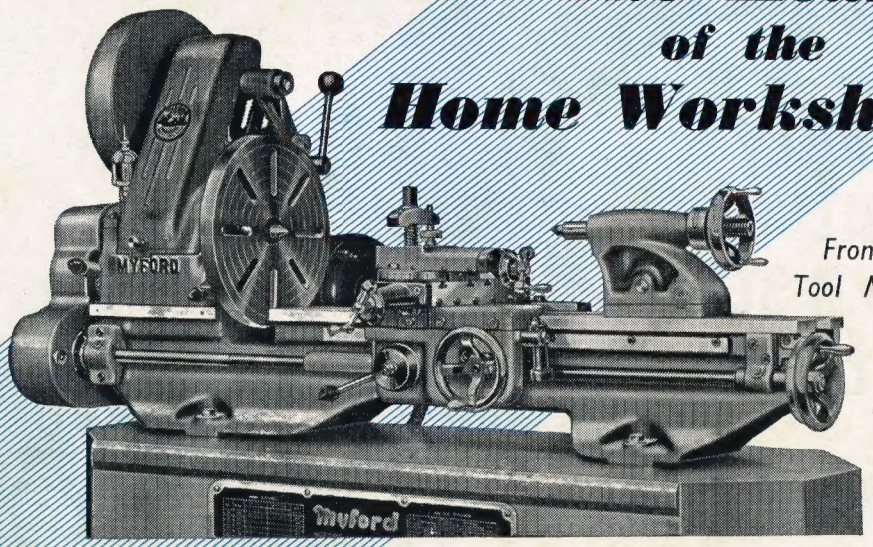

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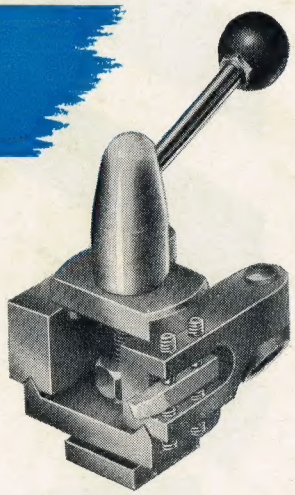

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